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Public Health Reports

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QUALIFICATIONS OF PROFESSIONAL PUBLIC HEALTH PERSONNEL [1]

IV. SANITATION PERSONNEL

By MAYHEW DERRYBERRY, *Senior Health Education Analyst,* and GEORGE CASWELL, *United States Public Health Service*

The sanitarian, sanitary inspector, or health inspector, was the first staff worker in the field of public health. Following Chadwick's sanitation survey in England [2] and the energetic work of Sir John Simon,[3] the sanitary inspector assumed a major role in the public health field. His early activities, beginning with environmental sanitation and including the removal of health hazards, were largely carried out through regulatory measures. The same method of procedure continues throughout much of the country today, although in some departments educational aspects of the position are emphasized.

In the past, when inspection and enforcement of the sanitary code were the chief functions of the sanitation worker, the only training required was a knowledge of the code to be enforced. More recently, however, with the advances in sanitary science, modern health departments no longer limit their activities to the development and enforcement of codes but have broadened their functions to include supervision over the hygiene of housing, control of milk and water supplies, precautionary measures against industrial hazards, and many other phases of community life formerly not considered. To perform these tasks, workers are needed who not only know the technical aspects of the work but also have an understanding of methods of dealing with and educating the public.

To what extent, then, is the present force of sanitary engineers and sanitary inspectors trained for these more complicated tasks? How

[1] From the Division of Public Health Methods, National Institute of Health. This is the fourth in the series: Qualifications of Professional Public Health Personnel. The preceding papers were: I. Plan and Scope of the Survey; II. Health Officers and Other Medical Personnel; and III. Nurses.

This survey was made possible through the cooperation of State and local health officers and members of their staffs throughout the country. Acknowledgment is also made of the extensive clerical assistance provided by the Works Progress Administration, Project No. 765-23-3-2. Data collected in 1938.

[2] *Cf.* Sanitary Condition of the Labouring Population of Great Britain, Report of the Poor Law Commissioners to Parliament, London, 1842.

[3] Simon, Sir John: English Sanitary Institutions Reviewed in Their Course of Development and in Some of Their Political and Social Relations. 2d ed. J. Murray, London, 1897.

many are working without any special preparation, and how much training will be required to provide a well-qualified corps of workers? To answer these questions and furnish similar facts for other types of personnel was the primary objective of a general survey of professional employees in health departments conducted recently by the Public Health Service.[4]

ADMINISTRATIVE CLASSIFICATION

In the course of the survey, individual schedules were collected from 4,443 sanitation workers in 1,114 health departments in the United States, including Alaska, Hawaii, and Puerto Rico. Although the study was not concerned with nonprofessional employees, there were 102 schedules from individuals whose functions seemed to differ so strikingly from those of the majority of the sanitation workers that it was decided to eliminate them from the analysis. Among the titles reported by this small group of employees were: (*a*) sanitary patrolman, (*b*) rat-, vermin-, or insect-control worker, (*c*) dog catcher, (*d*) poundmaster, and (*e*) complaint man.

The remaining 4,341 employees were classified according to function [5] as: (*a*) Directors of sanitary bureaus, (*b*) sanitary engineers (not heads of bureaus), and (*c*) staff sanitarians. From table 1 it will be seen that city health departments employ half of all the sanitation personnel working in official agencies; States and counties employ approximately two-fifths and three-fifths, respectively, of the remainder. However, city health departments employ fewer than one in ten of the trained professional sanitary engineers not directors of bureaus. That is, a sanitary engineer is seldom found in a city health department unless he is directing the sanitation corps. In some instances, the head of a bureau is a physician or veterinarian rather than an engineer. The relatively large number of sanitary engineers in State health departments is explained by the fact that State personnel generally serve as consultants to county and other smaller units.

Sanitation workers are predominantly white males. Only 1.4 percent of the total are women, mostly staff sanitarians employed in such positions as beauty-shop inspector or boarding-home inspector. Only 5 percent of the entire group are other than white. There are 22 Negro staff workers in cities; the remainder are Eurasian or "Hawaiian" or did not report color.[6]

[4] For a discussion of the method and coverage of the entire study, see the first paper in this series: Plan and Scope of the Survey.

[5] Directors of sanitary bureaus were classified as reported, regardless of status or training as engineers. Included with directors are those reported as acting or deputy directors. The group called "sanitary engineers" includes only professional engineers and industrial hygiene men, trained in engineering but not claiming supervisory control over any bureau. Staff sanitarians and veterinarians make up the third category.

[6] Most of those who are other than white or Negro are employed in Hawaii and Puerto Rico.

TABLE 1.—*Sanitation personnel by professional classification and employing jurisdiction*

Professional classification	Total		Employed by— State		County		City	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total	4,341	100.0	977	22.5	1,203	27.7	2,161	49.8
Director [1]	466	100.0	156	33.5	82	17.6	228	48.9
Sanitary engineer [2]	481	100.0	266	55.3	172	35.8	43	8.9
Staff	3,394	100.0	555	16.3	949	28.0	1,890	55.7

[1] Includes all reported as heads of sanitary corps or bureaus.
[2] Includes only trained sanitary engineers (or professional engineers) not heads of corps or bureaus.

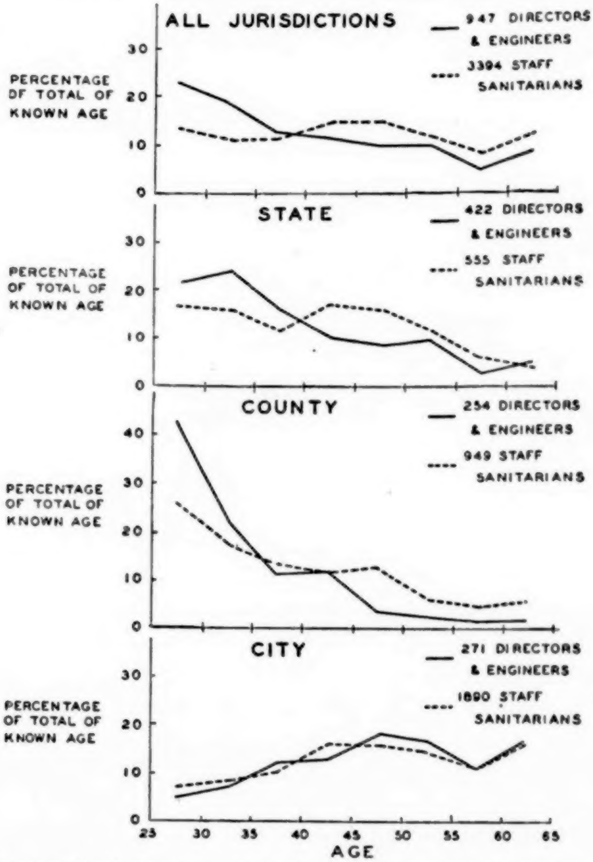

FIGURE 1.—Age of sanitation personnel, by class of position and employing jurisdiction.

In contrast to the homogeneity of sex and color, there is a complete lack of it with respect to age. There are wide jurisdictional variations in average age, and in both State and county departments staff workers are older than their supervisors. In the cities the two groups are of approximately the same age. Figure 1 shows the complete age distribution by type of position and jurisdiction. It might be pointed

out that city employees, averaging 48 years old, are, as a group, 9 years older than county employees and almost 8 years older than State employees. Staff workers average over 44 years old, 4 years more than directors and engineers.

The age relationship shown in figure 1 indicates an undesirable administrative situation. If the older employees, most of whom have several years of experience, were well trained, they should administer the program but, in reality, the result is that the older men are expected to accept supervision by those who are their juniors in both age and service.

Age differences such as those shown in figure 1 must be kept in mind in any interpretation of the material, whether it refers to training or experience. For example, only one-seventh of the city workers are under 35, but twice as many are 55 or over. In State and county departments the proportions are reversed. Such contrasts in age levels will undoubtedly have bearing not only on the present training problem but on future employment needs as well.

EDUCATIONAL QUALIFICATIONS

Academic training.—In analyzing the educational qualifications of sanitation workers, each individual was tabulated at the highest level attained, on the assumption that he had successfully completed work in the lower levels. Individuals reporting college training were assumed to have completed high school even though they did not report it. Those who indicated that they had graduate degrees were given credit for both high school and college graduation. The resulting tabulation of the level of educational training for each of the professional and jurisdictional categories is shown in table 2 in which all work of college grade is reported together.[7] Only in cases in which a degree was reported is it indicated whether college work was taken in an academic or a professional course.

Fifty-six percent of currently employed sanitation workers have had some college work and 36 percent have degrees. On the other hand, 15 percent have had less than high school training and almost one-third have gone no further than high school.

Sanitary engineers, nine-tenths of whom have college degrees, have the most extensive academic training and by far the best professional background of any of the groups. This is a much better showing than is made by the directors of sanitary bureaus, of whom one-third have had no college work and fewer than half have degrees. Fewer than half of the staff workers have attended college; only about one-fourth have college degrees. At the other extreme in level of training, there are over 17 percent of staff employees who have less than high school

[7] This fact should be noted when table 2 is compared with similar tables analyzing the training of physicians and nurses. In the latter, academic and professional work are analyzed separately. The manner in which the sanitarians reported their training precluded making such distinctions.

training and an additional fifth who attended high school but were not graduated.

TABLE 2.—*Level of academic training reported by sanitation personnel, according to jurisdictional and administrative classification*

Level of academic training reported	All sanitation personnel	State	County	City	Directors	Sanitary engineers	Staff
	Number						
Total	4,341	977	1,203	2,161	466	481	3,394
Less than high school	651	121	86	444	47	2	602
High school, no college	1,255	215	285	755	103	9	1,143
Less than graduation	779	132	152	495	65	3	711
Graduation	476	83	133	260	38	6	432
College work	2,169	565	742	862	274	399	1,496
No degree	880	147	328	405	96	43	741
Academic degree	639	233	239	167	88	185	366
Professional degree	650	185	175	290	90	171	389
Graduate training	266	76	90	100	42	71	153
	Percentage						
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Less than high school	15.0	12.4	7.1	20.6	10.1	0.4	17.7
High school, no college	28.9	22.0	23.7	34.9	22.1	1.8	33.7
Less than graduation	17.9	13.5	12.6	22.9	13.9	.6	21.0
Graduation	11.0	8.5	11.1	12.0	8.2	1.2	12.7
College work	50.0	57.8	61.7	39.9	58.8	83.0	44.1
No degree	20.3	15.0	27.3	18.8	20.6	8.9	21.8
Academic degree	14.7	23.9	19.9	7.7	18.9	38.5	10.8
Professional degree	15.0	18.9	14.5	13.4	19.3	35.6	11.5
Graduate training	6.1	7.8	7.5	4.6	9.0	14.8	4.5

Jurisdictional differences in academic and professional education among sanitation workers are similar to those previously shown in the papers analyzing the training of nurses and physicians. State and county workers have a much better academic background than the city sanitation workers in all the classifications. Fewer than half of the city workers have attended college and only one-fourth have degrees. An additional fifth report no high school training; about the same proportion have attended high school but not graduated.

Despite the meager educational background of a large proportion of the workers, the present situation represents a considerable improvement over the conditions revealed by the White House Conference in 1930.[8] (See table 3.) Only in the proportion who have less than high school training was the showing in 1930 better than that in 1938. Even this difference may result from the White House Conference tabulation of 23.2 percent of the total with "high school training unspecified." It is most likely that many of this unspecified group had no high school education.

[8] See Public Health Organization, vol. IIA, Reports of the White House Conference on Child Health and Protection, The Century Company, New York. 1932.

TABLE 3.—*Comparison of the educational training reported by sanitation personnel in 1938 and 1930*

Educational attainment reported	Percentage with specified training as reported in—	
	United States Public Health Service Survey, 1938	White House Conference Survey,[1] 1930
Less than high school	15.0	11.2
High school, no college training	28.9	48.6
Not graduated	17.9	14.7
Graduated	11.0	33.9
College	56.1	40.2
Less than graduation	20.3	19.4
Graduation	35.8	20.8
Number in survey	4,341	982

[1] In preparing the percentages for comparison with the present survey, the following assumptions were made: 4 years of college was considered graduation; "unspecified" college work was considered as no college work; and those representing the difference between the number reporting college work and the number reporting no high-school work were considered to have attended high school.

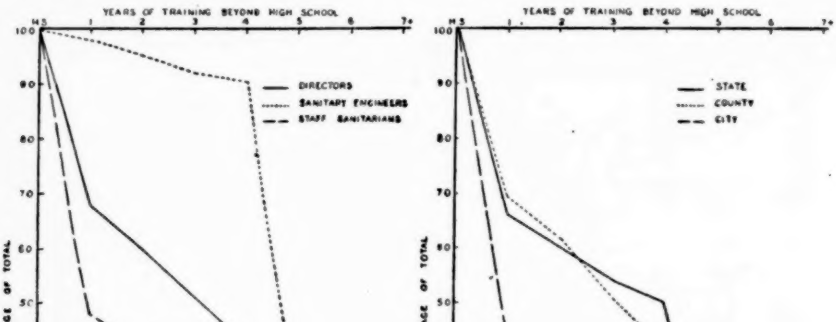

FIGURE 2.—Aggregate years of training beyond high school among sanitation personnel, percentages of functional and jurisdictional groups with specified years of training.

Another measure of the educational preparation of sanitarians is the reported length of their combined academic and professional training. As is shown in table 3, more than 40 percent of the entire group either do not report or have not had any training beyond high school. Among those who do report training of college level, the modal number of years reported is 4. Although relatively few report more than 4 years, there are 115 reporting 8 or more years.

The differences in the length of training for the administrative and jurisdictional groups are shown in figure 2. This chart has been constructed to show, by single years, the proportion having at least that number of years of educational work. The most outstanding difference between the groups is the superiority of the engineers' training. Ninety percent of them have had 4 or more years of training beyond high school, but only 42 percent of the directors and 24 percent of the staff have had that amount of training. The engineers exceed the other two groups at every point on the scale, although the difference is at its maximum at 4 years or more.

The general lower level of educational attainment for sanitation employees from cities as shown in figure 2 and table 3 is consistent with the findings previously reported for medical and nursing staffs.[9] It is obvious, therefore, that city health departments especially should consider the training needs of their present sanitation employees and raise their standards of employment in order that the quality of their sanitation personnel may be improved.

In tables 2 and 3 it was shown that 36 percent of the sanitation workers have either an academic or a professional degree. The types of degrees included under those two headings varied widely among the several groups; the most commonly reported ones are shown in table 4. Interpretation of the meaning of degrees in terms of the type of training they represent cannot be made too rigidly because of the variation in the practices of colleges granting degrees. In some institutions the degree of Bachelor of Science or Bachelor of Science in Sanitary Engineering, both of which were reported as academic degrees, would imply the same training as that represented by the degree of Sanitary Engineer (a definitely professional degree) in another institution. Since no criteria were available by which academic degrees could be distinguished from strictly professional ones, all have been tabulated exactly as they were recorded on the schedules. Twenty-one percent of sanitation personnel reported academic degrees; 15 percent reported professional degrees. Among the former, three out of four are bachelors of science. The number of such degrees is almost equal to the number of professional degrees; and, as stated above, it is probable that a majority of the science degrees, though reported as academic, belong in the professional training category.

The largest single group of professional degrees reported are in veterinary medicine.[10] Among the "other" category of bachelor's degrees and professional degrees were: Bachelor of Education, Bachelor of Philosophy, degrees in accountancy, and the various degrees granted by agricultural colleges. Among the sanitation

[9] See Nos. II and III of this series: Health Officers and Other Medical Personnel, and Nurses.

[10] Variously reported as: D. V. M., D. V. S., D. V., M. D. C., V. S., or B. V. Sc.

employees are 18 physicians whose functions in their departments are such that they are included here rather than with physicians in medical bureaus. Six are directors, 10 are in staff positions, and 2 are classified as sanitary engineers.

TABLE 4.—*Academic and professional degrees among sanitation personnel, by employment status*

Degree reported	All sanitation personnel	State	County	City	Directors	Sanitary engineers	Staff
	Number						
Total	4,341	977	1,203	2,161	466	481	3,394
No degree [1]	2,786	483	699	1,604	246	54	2,486
Academic degree	905	309	329	267	130	256	519
Bachelor of arts	171	41	88	42	30	16	125
Bachelor of science	631	238	220	173	86	206	339
Other bachelor's degrees	112	32	27	53	18	34	60
Professional degree	650	185	175	290	90	171	389
Doctor of medicine [2]	18	6	2	10	6	2	10
Civil engineer or sanitary engineer	74	37	28	9	11	44	19
Doctor of veterinary medicine	279	26	50	203	41	1	237
Bachelor of laws	27	6		21	7		20
Pharmacy	66	23	8	35	10		56
Other [3]	204	98	88	18	20	132	52
	Percentage						
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
No degree [1]	64.2	49.5	58.1	74.2	52.8	11.2	73.2
Academic degree	20.8	31.6	27.3	12.4	27.9	53.2	15.3
Bachelor of arts	3.9	4.2	7.3	1.9	6.4	3.3	3.7
Bachelor of science	14.5	24.4	18.3	8.0	18.5	42.8	10.0
Other bachelor's degrees	2.6	3.3	2.2	2.5	3.9	7.1	1.8
Professional degree	15.0	18.9	14.6	13.4	19.3	35.6	11.5
Doctor of medicine [2]	.4	.6	.2	.5	1.3	.4	.3
Civil engineer or sanitary engineer	1.7	3.8	2.3	.4	2.4	9.1	.6
Doctor of veterinary medicine	6.4	2.7	4.2	9.4	8.8	.2	7.0
Bachelor of laws	.6	.6		1.0	1.5		.6
Pharmacy	1.5	2.4	.7	1.6	2.1		1.6
Other [3]	4.7	10.0	7.3	.8	4.3	27.4	1.5

[1] Includes those having no college work as well as those whose college work is incomplete.
[2] Includes 1 with doctor of dental science.
[3] Largely degrees in accountancy, agriculture, and education.

It is of some interest to note that 27 individuals have degrees in law and 66 have degrees in pharmacy, chiefly State and city employees. The presence of lawyers in city sanitation staffs is suggestive of the continuance of regulatory practices as one of the functions long identified with the sanitary bureau.

Public health training.—The preceding tables have shown that a large proportion of employees in the sanitary corps of health departments have a limited educational background. This might not be a serious handicap to efficient health service if the workers had also received specific training in the theory and methods of public health.

Table 5, however, shows that the limitations of their public health training are even more pronounced than those of their academic background.

Only 29 percent of the sanitation employees in official health departments have had any public health training; of that number over four-fifths have had only special courses or in-service training. Of the remaining 5 percent of the total that have graduate public health training, three-fifths have less than 1 year's training and only 2 percent of the total have 1 year or more. Among sanitation employees the relative number of individuals with certificates or degrees is lower than in any other class of personnel, including laboratory workers.

TABLE 5.—*Levels of public health training reported by sanitation personnel, distributions by level of training and employment status*

Public health training reported	All sanitation personnel	State	County	City	Directors	Sanitary engineers	Staff
	Number						
Total	4,341	977	1,203	2,161	466	481	3,394
None	3,081	743	633	1,705	314	289	2,478
Special courses only	1,031	151	450	430	128	99	804
Less than 1 year	128	35	81	12	5	45	78
One year or more	101	48	39	14	19	48	34
Certificate or degree	90	38	42	10	17	38	35
	Percentage						
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
None	71.0	76.0	52.6	78.9	67.4	60.1	73.0
Special courses only	23.8	15.5	37.4	19.9	27.5	20.6	23.7
Less than 1 year	2.9	3.6	6.8	.5	1.0	9.3	2.3
One year or more	2.3	4.9	3.2	.7	4.1	10.0	1.0
Certificate or degree	2.1	3.9	3.5	.5	3.6	7.9	1.0

There has been little change in the public health training level of sanitation personnel in the last 10 years. The White House Conference [11] studied 982 sanitarians in 1930 and found that 2.5 percent had as much as 1 year of public health training. It is significant, however, that the Conference found only 12 percent that had had any public health training. Thus, it will be seen that while the proportion having some public health training has increased, the proportion achieving the standard recommended by the Conference of State and Territorial Health Officers has not.

Sanitary engineers report more public health training than any other group, but even so, only 10 percent have had a year or more of training. However, when it is recalled that much of their professional training is in the sanitary sciences, their apparent lack of public health training becomes of much less significance than it is in the other

[11] Op. cit., pp. 264 and 275.

groups. City workers, however, are as poorly trained in public health as they are in other respects. Four-fifths of the city employees have had no public health training and only 26 individuals, or 1 percent of the 2,100, have had any except in-service or special-course public health training. Only 10 city sanitarians have certificates or degrees.

Among the 90 certificates and degrees with public health majors reported there are 2 doctorates of philosophy, 2 doctorates of public health, 49 master's degrees, 1 diploma, and 1 bachelor of science. The remaining 35 are certificates. It has been previously pointed out that requirements vary among institutions and that it cannot be assumed that every certificate reported is based on a year or more of training. Although very few of the sanitarians report specific work in public health, their qualifications may be somewhat better than would appear, inasmuch as most of those with academic or professional training report science majors.

Despite the possible educational qualifications obtained through professional and science courses, there is a serious training problem among sanitation personnel as a whole, inasmuch as its leaders are largely untrained in public health. Fewer than 5 percent of the directors of sanitation bureaus meet the standards suggested by the Conference of State and Territorial Health Officers. The sanitary engineers make a somewhat better showing, but only 1 percent of staff sanitarians have had the amount of public health training suggested by the Conference.

TABLE 6.—*Comparison of percentage distributions of sanitation personnel by recency of employment and levels of public health training*

Sanitation personnel groups	Public health training level reported			
	None	Special courses	Less than 1 year	1 year or more
All groups	71.0	23.8	2.9	2.3
Old employees [1]	75.0	22.6	.9	1.5
New employees [2]	62.8	26.1	7.1	4.0
State employees	76.0	15.5	3.6	4.9
Old employees	82.3	12.5	1.3	3.9
New employees	65.6	20.4	7.4	6.6
County employees	52.6	37.4	6.8	3.2
Old employees	60.1	35.6	2.2	2.1
New employees	46.5	38.9	10.4	4.2
City employees	78.9	19.9	.5	.7
Old employees	77.0	22.1	.4	.5
New employees	87.0	10.2	1.5	1.3

[1] Employed prior to 1935.
[2] Employed in or subsequent to 1935.

As has been pointed out in the previous papers in this series, funds were made available for the training of public health employees with the passage of the Social Security Act, and recommendations as to qualifications for employment have been made by the Conference of

State and Territorial Health Officers. If these two actions have had any effect, one would expect newly appointed employees to be better trained than those employed continuously in their present jurisdictions longer than the Act has been in effect. Although the number of trained sanitation workers is still relatively small, there is some evidence in table 6 that progress has been made since 1935.

There is a smaller proportion of untrained workers and a larger proportion with at least 1 year of public health training among new employees than among the older ones in both States and counties. It is significant, however, that among recent appointees in cities, there is a higher percentage of untrained workers than among older employees. City health departments not only have the poorest trained staffs but are making the least progress in improving the situation.

If levels of public health training among the several personnel groups are analyzed by age, an additional evidence of progess is found. Table 7, showing percentages of age groups with specified training, reveals that in State and county departments the proportion of untrained workers under 35 years old is considerably less than the proportion of untrained workers over 50. Similarly, more young workers than old ones have had formal public health training. In the State and county health departments, therefore, the tendency to fill vacancies with trained men will in the course of time raise the general level of training; but, as has repeatedly been pointed out, there is no such tendency evident in cities.

TABLE 7.—*Percentage distribution of sanitation personnel by age and training in public health, percentages of age groups with specified training*

Age	Employing jurisdiction and training reported											
	State				County				City			
	None	Special courses only	Under 1 year	1 year or more	None	Special courses only	Under 1 year	1 year or more	None	Special courses only	Under 1 year	1 year or more
All ages	76.0	15.5	3.6	4.9	52.6	37.4	6.8	3.2	78.9	19.9	0.5	0.7
Under 25	55.9	29.4	8.8	5.9	43.4	42.1	10.5	4.0	92.9	7.1	------	------
25-29	62.1	19.6	9.8	8.5	38.6	42.3	11.4	7.7	82.4	14.8	2.8	------
30-34	67.7	18.5	6.4	7.4	41.8	43.6	11.8	2.8	73.4	22.5	1.7	2.4
35-39	75.0	20.6	.7	3.7	50.6	45.5	3.9	------	76.1	23.9	------	------
40-44	82.1	10.0	2.4	5.5	54.9	38.2	4.2	2.7	74.5	23.7	.6	1.2
45-49	83.1	12.9	.8	3.2	65.5	31.5	1.5	1.5	73.8	25.4	.2	.6
50-54	88.6	9.5	------	1.9	78.3	18.8	2.9	------	80.9	18.2	.3	.6
55-59	89.1	10.9	------	------	75.4	24.6	------	------	82.9	16.7	.4	------
60 or over	93.0	7.0	------	------	82.5	15.9	1.6	------	85.3	13.9	.3	.5
Unknown	100.0	--------	------	------	66.7	22.2	------	11.1	88.9	11.1	------	------

EMPLOYMENT EXPERIENCE OF SANITATION WORKERS

The questionnaire by means of which the data in this survey were collected, requested, in addition to the information on training already presented, the following items about present and past employment: (*a*) The title of each position held, (*b*) name and address

of each employing organization, (*c*) the number of years each position was held and whether it was full- or part-time, and (*d*) the type of organization by whom the individual was employed. The analysis of experience history that follows is therefore limited to employment as reported by the sanitarians themselves. In this, as in the previous papers, no assumptions are made regarding periods of unemployment which may not have been reported.

Types of experience.—It is generally recognized that, except for sanitary engineers and veterinarians, there is no common professional group from which other sanitation personnel are recruited. It is not surprising, therefore, to find their reported occupational experience widely varied. The more frequently mentioned occupations and the number of workers with experience in them are shown in table 8. Although 70 percent of the group have worked out of the field of public health, no single type of experience was reported in more than 12 percent of the cases. Engineering, sales and office work are the three types of experience most frequently mentioned.

TABLE 8.—*Types of experience reported by sanitation personnel*

Types of experience reported	All sanitation personnel	State	County	City	Directors	Sanitary engineers	Staff
	Number						
Total	4,341	977	1,203	2,161	466	481	3,394
Public health only	1,303	245	382	676	142	116	1,045
Other than public health [1]	3,038	732	821	1,485	324	365	2,349
Engineer [2]	420	211	153	56	61	229	130
Dairy inspector	238	47	63	128	58	4	176
Plumber or steamfitter	163	10	28	125	24	3	136
Sales work	443	74	140	229	28	19	396
Office work	515	138	114	263	38	29	448
Factory work	176	31	43	102	16	8	152
Farming	154	21	59	74	13	5	136
Bacteriologist or pharmacist	162	64	45	53	13	22	127
Veterinarian	214	15	50	149	25	4	185
Miscellaneous—other	1,413	345	419	649	180	165	1,068
	Percentage						
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Public health only	30.0	25.1	31.8	31.3	30.5	24.1	30.8
Other than public health [1]	70.0	74.9	68.2	68.7	69.5	75.9	69.2
Engineer [2]	9.7	21.6	12.7	2.6	13.1	47.6	3.8
Dairy inspector	5.5	4.8	5.2	5.9	12.4	.8	5.2
Plumber or steamfitter	3.8	1.0	2.3	5.8	5.2	.6	4.0
Sales work	10.2	7.6	11.6	10.6	6.0	4.0	11.7
Office work	11.9	14.1	9.5	12.2	8.2	6.0	13.2
Factory work	4.1	3.2	3.6	4.7	3.4	1.7	4.5
Farming	3.5	2.1	4.9	3.4	2.8	1.0	4.0
Bacteriologist or pharmacist	3.7	6.6	3.7	2.5	2.8	4.6	3.7
Veterinarian	4.9	1.5	4.2	6.9	5.4	.8	5.5
Miscellaneous—other	32.6	35.3	34.8	30.0	38.6	34.3	31.5

[1] Combinations of experience are not shown but numbers and percentages are shown for each type of experience reported.
[2] Not including experience as sanitary engineer.

In relatively few of the categories listed in table 8 is there any obvious relationship between prior experience and present employment. Furthermore, jurisdictional differences and those between functional groups are most striking. For example, although fewer than 10 percent of all sanitation personnel report previous engineering experience, almost one-half the sanitary engineers and one-fifth of State employees have had it. Relatively 8 times as many State employees as city employees have had such experience. Granting that small groups have had experience that might be good preparation for their present employment, sanitation personnel as a class have not. Sanitation corps staffs frequently come from occupations which could hardly be expected to contribute to their success in the corps.

Public health experience.—Sanitation workers report on the average longer experience in public health than either physicians or nurses. Their average experience is 9.9 years in public health as compared with 8.2 years for physicians and 9.0 years for nurses. This is about 1 year longer than the average experience found in the White House Conference Survey in 1930.[12]

Jurisdictional differences in length of service are shown in table 9, in which it will be seen that city employees have an average of 12.3 years' service, a much longer public health experience than those from States (9.0 years) or counties (6.2 years). The city employees' length of service is exceeded only by that of sanitation directors who average 13.7 years in the field. County employees and sanitary engineers, the youngest groups, have had the shortest average experience, 6.2 and 6.4 years, respectively. This difference is to be expected since expansion, chiefly in county and State units, has only recently brought the younger men into public health.

The relatively long employment in public health shown in table 9 might be considered to compensate for the limited amount of public health training shown earlier. However, it should be pointed out that the only experience of approximately 20 percent of the sanitation workers is their present public health job. Furthermore, another 50 percent have had only one position, the present one, in public health, even though they have had other employment. Thus, only 30 percent of the currently employed sanitarians have broadened their understanding of public health through employment in a number of situations. Distributions of the number of periods of public health employment for the administrative and jurisdictional groups are shown in table 10. Both the State and the county personnel have had greater variety in their experience than the city workers, 80 percent of whom have had only their present public health job. The directors have had a broader experience than any other group.

[12] Op. cit., p. 275.

TABLE 9.—*Length of public health experience among sanitation personnel by employment status*

Number of years of public health [1] experience reported	All sanitation personnel	State	County	City	Directors	Sanitary engineers	Staff
	Number						
Total	4,341	977	1,203	2,161	466	481	3,394
Under 5	1,743	441	737	565	118	293	1,332
5-9	743	178	196	369	60	76	607
10-14	835	139	170	526	91	59	685
15-19	475	121	66	288	76	35	364
20-24	271	57	22	192	58	14	199
25-29	171	28	7	136	38	4	129
30 or more	103	13	5	85	25	---------	78
Average (years)	9.9	9.0	6.2	12.3	13.7	6.4	9.8
	Percentage						
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Under 5	40.2	45.2	61.3	26.2	25.3	60.9	39.2
5-9	17.1	18.2	16.3	17.1	12.9	15.8	17.9
10-14	19.2	14.2	14.1	24.3	19.5	12.3	20.2
15-19	10.9	12.4	5.5	13.3	16.3	7.3	10.7
20-24	6.3	5.8	1.8	8.9	12.4	2.9	5.9
25-29	3.9	2.9	.6	6.3	8.2	.8	3.8
30 or more	2.4	1.3	.4	3.9	5.4	---------	2.3

[1] Includes those who reported only one position (present position) in public health.

TABLE 10.—*Periods of public health employment reported by sanitation personnel, by number of periods, and employment status*

Number of periods of public health employment reported	All sanitation personnel	State	County	City	Directors	Sanitary engineers	Staff
	Number						
Total	4,341	977	1,203	2,161	466	481	3,394
1 [1]	3,071	588	751	1,732	183	250	2,638
2	736	196	263	277	140	120	476
3	301	103	106	92	79	57	165
4	127	48	44	35	29	33	65
5 or more	106	42	39	25	35	21	50
Average (periods)	1.5	1.7	1.6	1.3	2.1	1.9	1.4
	Percentage						
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1 [1]	70.7	60.2	62.4	80.1	39.3	52.0	77.7
2	17.0	20.1	21.9	12.8	30.0	24.9	14.0
3	6.9	10.5	8.8	4.3	17.0	11.9	4.9
4	2.9	4.9	3.7	1.6	6.2	6.9	1.9
5 or more	2.5	4.3	3.2	1.2	7.5	4.3	1.5

[1] Includes those reporting only present position.

The limited range of experience is further emphasized by a tabulation of the number who have worked in more than one State. The experience of 95 percent of the total and 97 percent of the staff workers has been restricted to one State. More sanitary engineers than directors or staff workers have had experience in two or more States, although the proportion even in this group is only one out of six. Among the jurisdictional groupings, city employees, with the longest public health employment, are also the most limited in variety of experience since only 2 percent of them have worked in more than one State. For the State and the county workers the percentages are 10 and 7, respectively.

Still another indication of the limited public health experience of sanitation workers is the very small number who have worked in other agencies, such as nonofficial health agencies. About 12 percent of the total have served in the United States Public Health Service, Army or Navy, or voluntary health agencies. Two-thirds of this experience was in the Army or Navy and was gained by the older sanitarians at about the time of the World War. It is doubtful whether much of their experience in the armed forces was of a public health nature. The greatest number reporting such service is found among staff sanitarians, especially those in cities.

Stability of employment in public health.—All the previous evidence points to the fact that employment in sanitary corps is quite stable. It should be borne in mind that almost three-fourths of the workers have had public health experience only in the position they are now occupying, and that the average length of their public health employment is greater than that of physicians or nurses. Since so few sanitarians have had other public health positions, the length of their present employment would naturally approximate their total public health experience. In fact, the average length of present employment differs from that of total public health experience by less than 1 year for every group except directors, for whom the difference is only slightly over a year. A further index of stability, the number of positions in other fields after the first employment in public health, likewise reveals very stable employment.

More than 93 percent of the sanitation personnel now in service have worked continuously in the field ever since entering it. Even among those who have had at least one period of employment in a different field after an initial employment in public health, the average of such "interruptions" is 2 periods per individual (see table 11). State employees, sanitation directors, and sanitary engineers are the only classes in which as many as 9 percent have had any interruption to their service in public health.

TABLE 11.—*Employment in other fields after initial employment in public health, as reported by sanitation personnel*

Number of periods of employment in other fields after first period in public health	All sanitation personnel	State	County	City	Directors	Sanitary engineers	Staff
	Number						
Total	4,341	977	1,203	2,161	466	481	3,394
None	4,053	888	1,110	2,055	416	427	3,210
1	152	51	44	57	30	34	88
2	53	15	20	18	8	8	37
3	40	14	13	13	6	8	26
4	18	3	5	10	2	1	15
5 or more	25	6	11	8	4	3	18
Average number of periods of employment in other fields (for those having any such employment)	2.0	1.9	2.1	2.0	1.8	1.7	2.1
	Percentage						
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
None	93.4	90.9	92.3	95.1	89.3	88.7	94.6
1	3.5	5.2	3.6	2.6	6.4	7.1	2.6
2	1.2	1.6	1.7	.8	1.7	1.7	1.1
3	.9	1.4	1.1	.6	1.3	1.7	.8
4	.4	.3	.4	.5	.4	.2	.4
5 or more	.6	.6	.9	.4	.9	.6	.5

Although from the standpoint of the worker, stability of employment, such as has been described for sanitation personnel, makes the position a desirable one to hold, it is still probable that opportunity for promotion or change of position is even more desirable to stimulate an alert worker to advancement. From the administrator's point of view the position of the sanitarian is perhaps too stable, and as a result, professional stagnation seems to be taking place.

SUMMARY AND DISCUSSION

1. Sanitation personnel make up about one-fourth of all full-time health department employees. Out of each 9 sanitation employees, 7 are staff sanitarians, 1 is a sanitation director, and 1 is a sanitary engineer. Over half the sanitary engineers work for State health departments; over half the staff sanitarians work for cities.

2. There is wide variation in the age levels of sanitation workers, the only professional group whose staff employees are older than their supervisors. Among the jurisdictional groups, city sanitarians are the oldest, those from counties the youngest.

3. Sanitary engineers as a class are, in every respect, more thoroughly trained than their directors and both groups far surpass staff sanitarians in educational background. Ninety percent of sanitary engineers have at least 4 years of training beyond high school and about the same proportion have academic or professional degrees.

The only important jurisdictional contrast in the academic and professional training of sanitarians is that city employees as a group fall below those from either States or counties at every point on the scale.

4. Sanitation workers have had less public health training than either physicians or nurses. Only 5 percent have had any graduate public health training; only about 2½ percent have had as much as a year. One in 20 State employees and one in 10 sanitary engineers has the public health qualifications recommended by the Conference of State and Territorial Health Officers.

5. Analysis of public health training by age and recency of employment shows some improvement in the quality of personnel recently employed, except in city departments where the youngest employees have less training than any other age group. The Social Security Act has apparently operated to supplement the training of relatively small numbers of State and county sanitation workers.

6. It is apparent from the employment experience reported that there is a high degree of job security in sanitary corps. Workers are, however, recruited from no particular professional or other occupational group, and in most cases come into public health with little or no experience or specialized training that might guide them in their duties.

7. Tenure in the sanitary corps seems to be longer than in other professional groups studied, especially in city departments, whose employees have an average experience of more than 12 years. Sanitation directors as a group have an even longer average tenure (almost 14 years) in the field.

8. Over 70 percent of all sanitarians and 80 percent of the city employees have had only one job in the field of public health.

9. Breadth of experience from working in different States, for other agencies, or at different sorts of positions in public health is only rarely found among sanitation personnel. It is apparently not difficult to hold a position once it is gained; but advancement seems unlikely for the majority of the group.

STUDIES ON ACTIVE AND PASSIVE IMMUNITY IN "Q" FEVER INFECTED AND IMMUNIZED GUINEA PIGS [1]

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The occurrence of "Q" fever among meat workers and dairy farmers, first reported by Derrick in 1937 (*1*), and the recent occurrence of cases of pneumonitis caused by the virus of "Q" fever among employees of the National Institute of Health (*2*), suggesting the possibility of a relationship with certain other outbreaks of pneumonitis de-

[1] From the Division of Infectious Diseases, National Institute of Health.

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scribed in the literature, emphasize the importance of immunological studies. This is particularly true in the matter of diagnosis, since the disease may be confused with other rickettsial diseases or other diseases of virus or bacterial origin. Derrick states that the outstanding symptoms are fever and headache. This also describes the symptoms of most of the cases among employees of the National Institute of Health. These symptoms also characterize cases of mild endemic typhus in which the rash may be so slight as to be overlooked.

Burnet and Freeman (*3*) found that sera from convalescent patients protected laboratory animals against the disease. In our series neutralizing antibodies were also shown to be present in convalescent sera, although results were not complete (*2*). Agglutination of "Q" fever antigen by convalescent sera was demonstrated in the majority of our cases, the sera having been drawn 24 days to 55 days after the onset of illness (*2*). The possibility of early diagnosis by complement fixation should be considered. Whether the virus neutralizing properties of convalescent serum run parallel with the agglutinating and complement fixing antibodies is a question of importance. Bedson (*4*), in a study of psittacosis antibodies, demonstrates that the agglutinins and complement fixing antibodies are present in hyperimmune serum although the virus neutralizing antibodies are very weak. Also convalescent sera fixed complement though neutralizing antibody could not be detected. In certain other virus diseases, the neutralizing antibody is in evidence at the same time or earlier than the complement fixing or agglutinating antibodies.

EXPERIMENTAL

In this study, information which might have a bearing on the aspects of active and passive immunity in "Q" fever was sought in experiments on guinea pigs, using vaccines prepared from rickettsiae cultivated in various ways and immune sera obtained by injecting rabbits and guinea pigs with killed and living cultures of rickettsiae. The strains used were the "X" strain (*5*) and the "M" strain (*2*) of the National Institute of Health.

Methods of cultivation of rickettsiae.—The study involved an investigation of the methods most suitable for obtaining the largest numbers of rickettsiae. For this purpose both the methods of Cox (*7*), who has used infected yolk sac, and those of Burnet and Freeman (*3*), who have used infected mouse spleen, have been employed, as well as a combination of these methods.

In both the mouse spleen and yolk sac cultivation there is a period of adaptation before maximum multiplication is obtained when guinea pig material is used as the initial inoculum. In the yolk sac method this is indicated by the relatively long incubation period

necessary before the virus kills the embryo in the first passage. This incubation period is also dependent on the strength of the virus used for initiating growth in the chick embryo. A longer incubation was required with citrated or defibrinated blood than with spleen or liver. With blood it might vary from 10 to 12 days, while with infected spleen it was usually 7 to 8 days or occasionally 9 or 10 days. The titer of both could be increased and the incubation period shortened most rapidly by making transfer around the time when it was evident that deaths were resulting from the effect of the virus as indicated by candling. With spleen inoculum, the incubation period was usually shortened to 5 or 6 days and after 3 or 4 further passages it was decreased to 4 days and occasionally to 3 days. However, there was considerable fluctuation. Apparently the rickettsiae are most numerous just before the death of the embryo, but the impracticability of determining this accurately sometimes prevents transfer at the optimum time. When tranfers are made much before the optimum time they have the effect of increasing the incubation period and reducing the titers of the infected material. However, titers of 1×10^{-9} or over were usually obtained very regularly after the first few transfers.

A similar adaptation of guinea pig virus to the mouse was observed. Microscopic examination of spleen and liver for the presence of rickettsiae revealed few rickettsiae in the first passage. The rickettsiae were increased in the second passage and usually became very numerous in the third or fourth passages, although, as in the case of the chick embryos, the titer of the infected spleen sometimes underwent fluctuations, as transfer could not be made at the optimum time. Occasionally the number of rickettsiae diminished in later passages. It is possible that by recording temperatures of mice the optimum time of transfer might be determined and the number of rickettsiae maintained at approximately the same levels.

Increase in virulence for mice and guinea pigs by yolk sac passage.—In the routine passage of "Q" fever strains in guinea pigs by transfer of the blood of an infected guinea pig on the second or third day of fever, the usual course of the disease is indicated by elevation of temperature, beginning on the fourth or fifth day and continuing for from 3 to 8 days. This is then followed by a drop in temperature and apparent recovery. In mice also, after the virus has become established following the original inoculum of guinea pig spleen or blood, and routine transfers are made with 10 percent suspensions of infected mouse spleens, the mice appear healthy and no deaths occur.

If, however, 10 percent suspensions of infected yolk sac are used for the inoculation of mice and guinea pigs, particularly after 3 or 4 passages in chick embryos when the titer has reached 1×10^{-9} or over,

there was evidence of much higher virulence. This was more marked if infected guinea pig spleen was used as original inoculum into the yolks rather than infected guinea pig blood.

When the inoculum into the guinea pig was 1×10^{-1} dilution of yolk sac, elevation of temperature to 40° C. or over usually occurred on the following day, sometimes on the second day, and occasionally on the third day following inoculation. The number of days of elevated temperature varied from 2 to 6, followed by death in practically all cases in 4 to 7 days. The spleens and livers showed high concentrations of rickettsiae. With 1×10^{-2} dilutions of yolk sac which reached a titer of 1×10^{-9}, the inoculated guinea pigs showed elevated temperatures sometimes on the day following inoculation or on the second, third, or fourth day, usually followed by death on the fifth to the twelfth day. Early rise in temperature also occurred with 1×10^{-3} or occasionally higher dilutions, also often followed by death on the seventh to the seventeenth day. There were also deaths with dilutions 1×10^{-4}, 1×10^{-5}, and 1×10^{-6}, and occasionally with higher dilutions.

Spleens from guinea pigs inoculated with high titer yolk sac, when titrated in other guinea pigs, were infective in dilutions up to 1×10^{-9} and 1×10^{-10}. Such spleens also caused death of guinea pigs when injected in dilutions of 1×10^{-1} and sometimes up to 1×10^{-3}. In contrast, spleens from guinea pigs injected with blood for routine passage were found to be infective in dilutions of 1×10^{-5} and 1×10^{-6}.

When high titer yolk sac was used for inoculating mice, symptoms of roughened fur, inactivity, and a generally ill appearance developed, in some cases followed by death. The spleens of these mice were highly virulent, sometimes reaching a titer of 1×10^{-11} and killing guinea pigs with dilutions of 1×10^{-1}, 1×10^{-2}, or even higher.

In routine passage in mice by infected mouse spleen, when the initial inoculum had been guinea pig spleen, a titer of 1×10^{-9} was reached after three or four passages at weekly intervals.

Distribution of rickettsiae in mice and guinea pigs.—As a rule rickettsiae were more numerous in the spleens of infected mice than they were in the livers, but when they were more numerous than usual in the spleens they were correspondingly more numerous in the livers and occasionally they appeared as numerous in the livers as in the spleens. Likewise, the more numerous the rickettsiae were in the spleens, the more likely were they to be found in the lungs, although they were never as numerous in the latter location following intraperitoneal inoculation, the usual method employed, as they were in the livers.

The protocol given in table 1 indicates the results obtained in a series of mice inoculated intraperitoneally with 0.5 cc. of a 10 percent

suspension of infected yolk sac in the sixth passage on the fourth day after inoculation into the yolk.

TABLE 1.—*Rickettsiae in mice inoculated with infected yolk sac*

Mouse No.	Rickettsiae (after 12 days)			Mouse No.	Rickettsiae (after 12 days)		
	Spleen	Liver	Lungs		Spleen	Liver	Lungs
1	(1)	--------	--------	7	(1)	--------	--------
2	+++	++	+	8	(1)	--------	--------
3	+++	++	±	9	(1)	--------	--------
4	+++	++	±	10	+++	++	+
5	+++	+++	±	11	++	++	±
6	+++	+++	++	12	+++	+++	++

[1] Died in 10 days

Likewise, guinea pigs inoculated intraperitoneally with 1 cc. of a 10 percent suspension of infected yolk sac at times had almost as many rickettsiae in the livers as in the spleens. The protocol shown in table 2 is an illustration of the temperature reactions and also indicates the relative numbers of rickettsiae.

TABLE 2.—*Rickettsiae in guinea pigs inoculated with infected yolk sac*

Guinea pig No.	Temperature elevation, days following inoculation				Rickettsiae (5th day)		Guinea pig No.	Temperature elevation, days following inoculation				Rickettsiae (5th day)	
	1	2	3	4	Spleen	Liver		1	2	3	4	Spleen	Liver
12	40.7	41.0	------	40.4	+++	++	14	40.2	41.2	------	40.7	+	++
13	41.4	41.2	------	40.8	+	±	15	40.8	41.0	------	41.0	+	±

The spleens and livers of infected mice and guinea pigs when showing ++ and +++ rickettsiae offer the advantage of a larger quantity of infected tissue than the yolk sac affords. In particular, if infection showing this many rickettsiae in guinea pig spleen occurs then a very large number of rickettsiae may be recovered, since this organ may weigh 3 to 4 grams. Spleens from 8 guinea pigs averaged 3.4 grams and the livers 28 grams. Spleens from 100 mice averaged 0.35 gram and the livers 1.5 grams.

PREPARATION OF VACCINES AND SUSPENSIONS OF RICKETTSIAE FOR IMMUNIZATION PURPOSES

Infected yolk sacs and infected mouse spleens and livers, as well as guinea pig spleens, were employed in the preparation of a number of vaccines and suspensions which were used for the immunization of guinea pigs and rabbits and also in agglutination tests. The mouse and guinea pig tissues were preferred to the yolk sacs on account of the greater ease of manipulation, less difficulty being experienced in freeing the rickettsiae from extraneous tissue.

A 10 percent suspension by weight in sterile buffered 0.85 percent saline adjusted to pH 7.0 was prepared after first macerating the tissue in a mortar with alundum or grinding in an electrically operated mixer without alundum. Phenol was added in the ratio of 1 percent and the formalin in 0.5 percent. These suspensions were allowed to stand at ice-box temperature for varying periods of time. The heavier particles were precipitated by light centrifugation for 5 minutes. The supernatant fluid was then centrifuged at high speed (3,500 r. p. m. for 1¼ hours in the horizontal centrifuge or 5,000 r. p. m. for 30 minutes in an angle centrifuge). The precipitate was resuspended in sterile saline and again centrifuged lightly to precipitate the larger particles, the greater number of rickettsiae being present in the supernatant fluid. The precipitate was extracted several times by further addition of sterile saline followed by light centrifugation and additional rickettsiae were thus obtained. The final volume of the suspension of rickettsiae was equal to that of the original 10 percent suspension or was more concentrated. If it was desired to obtain suspensions as free of tissue as possible, the method of Léon as previously described (*8*) was used, or if a suspension relatively free from tissue was desired, this could be obtained by allowing the suspension to stand at ice-box temperature for a week or longer, when the greater part of the tissue would be precipitated as a brownish deposit. Phenol in the ratio of 0.4 percent and formalin in 0.1 percent were added as preservatives in the suspensions used as vaccines, and in those used as antigens in agglutination tests merthiolate was added to a dilution of 1:10,000.

Results in guinea pigs.—For the preparation of vaccine D infected mouse spleens and livers (strain "X") from mice showing ++ and ++++ rickettsiae in both spleens and livers were employed. A titration of the spleen of one mouse showed that it was infective in guinea pigs in a dilution of 1×10^{-9}. This vaccine was prepared as described and treated with 0.4 percent phenol and 0.1 percent formalin. Guinea pigs were given two subcutaneous inoculations, a week apart, of 1 cc. of the following concentrations: 2½ percent, 5 percent, 10 percent, and 20 percent, based on the weight of tissue from which the vaccine was prepared.

Figures 1 and 2 show the results obtained on testing for immunity. Half of the animals were tested with infected guinea pig spleen on the eighteenth day following the inoculation of the vaccine. The remainder were tested with infected yolk sac on the twenty-third day following the administration of the vaccine.

Spleens from guinea pigs infected with the "X" and the "M" strains of "Q" fever were used in parallel tests to determine immunity, using 10 percent suspensions of the spleens. With one exception, there was complete immunity throughout, the results being as favorable with the 2½ percent suspension as with the 20 percent. (See

fig. 1.) No titration was made of the infected spleen used in testing for immunity, but all control animals inoculated with the 10 percent suspension showed typical temperature reactions.

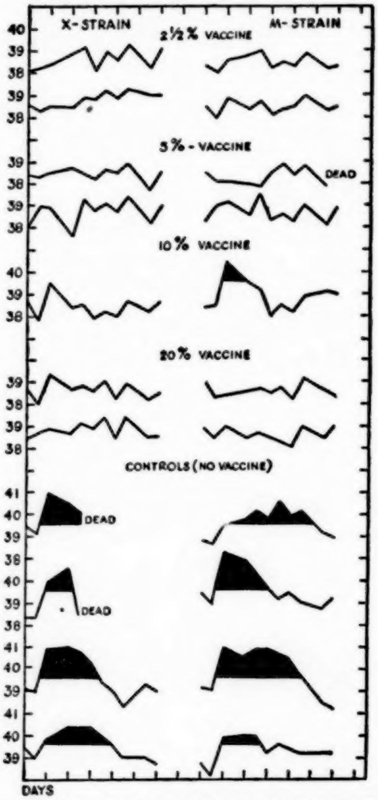

FIGURE 1.—Vaccine D. Test for active immunity in vaccinated guinea pigs using infected guinea pig spleen suspensions of the "X" and "M" strains.

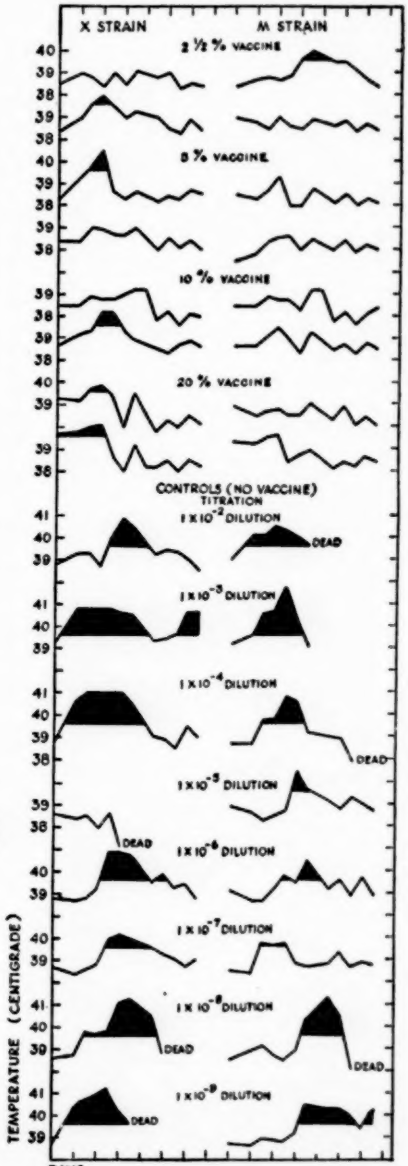

FIGURE 2.—Vaccine D. Test for active immunity in vaccinated guinea pigs using infected yolk sac suspensions of the "X" and "M" strains.

The results obtained in the series tested for immunity with infected yolk sac (1×10^{-2} dilution) are shown in figure 2. As in the other series, tests were made with yolk sacs infected with both the "X" and

the "M" strains of "Q" fever. Practically complete protection was afforded against the "M" strain (slight elevation of temperature in one animal which had received the 2½ percent suspension). Protection against the "X" strain was not as clear cut, though in nearly all cases one animal of each pair was completely protected.

In one animal which had received the 20 percent vaccine the rise in temperature at the beginning indicated a secondary infection. In the others showing temperature elevations this occurred for 1 or 2 days and the significance is questionable.

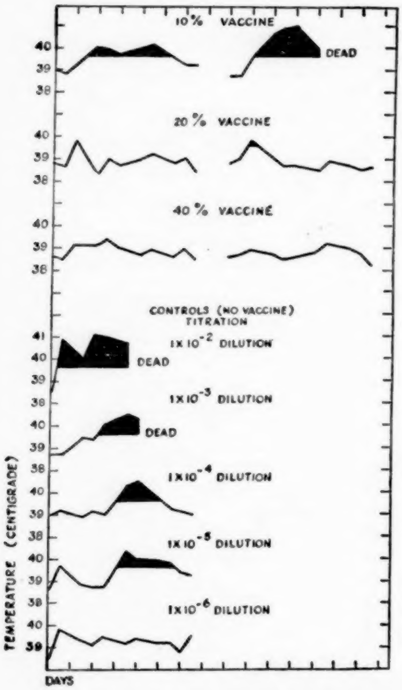

FIGURE 3.—Vaccine XXII. Test for active immunity in vaccinated guinea pigs using infected guinea pig spleen suspension of the "X" strain. Two inoculations of vaccine.

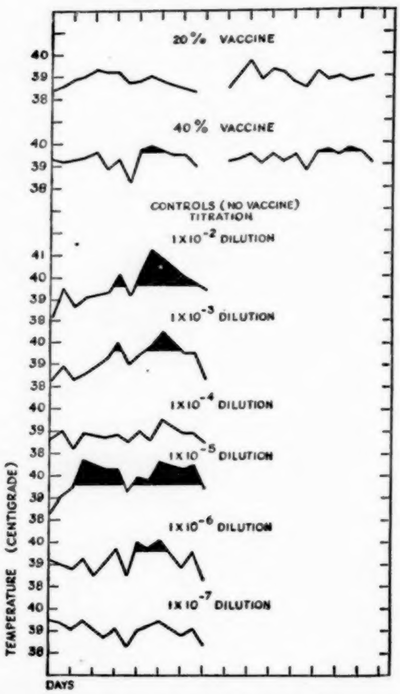

FIGURE 4.—Vaccine XXII. Test for active immunity in vaccinated guinea pigs using infected guinea pig spleen suspension of the "X" strain. One inoculation of vaccine.

Titration of both the "X" strain and the "M" strain showed that they were infectious in dilutions of 1×10^{-9}. The vaccines were, therefore, effective against 10,000,000 infective doses.

Another vaccine (XXII) was prepared from infected mouse livers. Although rickettsiae were recorded as ++ and +++ in the spleens of these mice, in the liver they were recorded as + or less. The method of preparation was similar to that described for vaccine D, the total volume of the 10 percent suspension being 470 cc. (livers from 23 mice). After centrifugation of the crude suspension, the precipitated rickettsiae were suspended in one-eighth the original volume (i.e., 59 cc.) of buffered saline solution (pH 7.0) and the tissue

precipitated and removed as previously described. For the tests in guinea pigs the vaccine was diluted one-half, one-quarter, and one-eighth, corresponding to 40 percent, 20 percent, and 10 percent of the original material.

Guinea pigs received either 1 or 2 subcutaneous inoculations of 1 cc. each of the 3 different concentrations. Tests for immunity were made approximately 2 weeks after the last inoculation, using 10 percent suspensions of guinea pig spleens. The results are shown in figures 3 and 4, figure 3 showing the results obtained with two inoculations of vaccine and figure 4, the results following one inoculation of vaccine. Practically complete protection was afforded by the 20 and 40 percent concentrations of vaccine following two inoculations, but the 10 percent concentration definitely failed to protect against 1 cc. of 1×10^{-1} suspension of "X" strain infected guinea pig spleen. There was no elevation of temperature with the 40 percent vaccine and a very slight elevation for one day with the 20 percent concentration. On titration this spleen was infective in 1×10^{-5} dilution. Protection was, therefore, afforded against 10,000 minimal infectious doses.

The guinea pigs receiving one inoculation of the 20 percent vaccine were completely protected against 1 cc. of a 1×10^{-1} dilution of "X" strain infected guinea pig spleen and those receiving the 40 percent concentration, though showing very slight elevation of temperature for 1 or 2 days, were probably also protected against the same amount of infected guinea pig spleen. A titration of the spleen material used for testing the immunity of the vaccinated animals indicates infection in a dilution of 1×10^{-6}. Protection was, therefore, afforded against 100,000 minimal infectious doses.

The results with another vaccine (XXI) made from mouse spleens tested in guinea pigs are summarized in table 3.

TABLE 3.—*Results of immunity test in guinea pigs receiving one and two inoculations of vaccine XXI made from mouse spleen*

Concentration, percent	Number of guinea pigs inoculated	Number of inoculations	Results of immunity test		Concentration, percent	Number of guinea pigs inoculated	Number of inoculations	Results of immunity test	
2½	2	2	I	I	10	2	1	I	D
	2	1	I	I	20	2	2	I	I
5	2	2	I	I		2	1	I	I
	2	1	I	D					

I=Immune. D=Died.

The titer of infected guinea pig spleen used for immunity test was 1×10^{-6}, the inoculum in the immunity test being a 1×10^{-1} dilution of spleen. Therefore, protection was afforded against 100,000 minimal infective doses. One inoculation of the 2½ percent vaccine was apparently as effective in protecting against this amount of virus as

were two inoculations of the 20 percent material. The spleens from which this vaccine was prepared were infective for guinea pigs in 1×10^{-9} dilution or less. One cc. of the 2½ percent suspension, therefore, contained 25,000,000 or more rickettsiae, indicating good antigenicity.

Vaccines were prepared from infected yolk sac which on titration was shown to be infective in a dilution of 1×10^{-9}. In testing for immunity the vaccinated animals were inoculated intraperitoneally with 1 cc. of a 1×10^{-1} dilution of infected guinea pig spleen 2 weeks after the last inoculation. The results with the yolk sac vaccine are shown in table 4.

TABLE 4.—*Results of immunity test in guinea pigs receiving one and two inoculations of vaccine XV*

Concentration, percent	Number of guinea pigs inoculated	Number of inoculations	Results of immunity test		Concentration, percent	Number of guinea pigs inoculated	Number of inoculations	Results of immunity test	
2½	2	2	NI	NI	10	2	2	I	I
	2	1	NI	D		2	1	NI	NI
5	2	2	I	D					
	2	1	NI	NI					

NI=None immune. I=Immune. D=Died.

The results obtained with the yolk sac vaccine show that two inoculations of the 5 percent and 10 percent concentrations afforded immunity against the test dose of infected guinea pig spleen used, while one inoculation failed to immunize. The 2½ percent vaccine was not effective with either one or two inoculations. It seems probable that the method used for separating tissue and rickettsiae was not as efficient as with the mouse tissues, since the original material was infective in a titer of 1×10^{-9}. It seems logical to assume that the efficiency of the vaccine is primarily dependent on the number of rickettsiae, although the presence of foreign tissue components may interfere with the response to the specific rickettsial antigen. Therefore, it is very probable that with purer suspensions as good results would be otained as with mouse infected tissue vaccines.

PASSIVE IMMUNITY IN GUINEA PIGS

Protection tests in animals are valuable in the diagnosis of disease and in the differentiation of diseases which have similar symptoms. Results with several convalescent sera from the series of cases occurring at the National Institute of Health showed that they had demonstrable virus neutralizing antibodies against the "M" strain in tests on guinea pigs (*2*). However, these tests were not entirely conclusive. In order to obtain further information on this subject, tests have been made with sera from experimentally infected guinea pigs and

from guinea pigs immunized by the inoculation of vaccines followed by living rickettsiae.

In testing for passive immunity varying amounts of immune sera (0.01, 0.02, 0.05, 0.1, 0.2, and 0.5 cc.) were mixed with a constant amount of infected guinea pig plasma (0.5 cc.) or spleen and liver suspension and allowed to stand at room temperature for one-half hour before being inoculated intraperitoneally into the animals under test.

In preparing the mixtures, the undiluted serum was measured in 0.5, 0.2, and 0.1 cc. amounts into conical glasses. Similarly 0.5, 0.2, and 0.1 cc. amounts of the serum diluted 1 : 10 with sterile 0.85 percent saline were measured into conical glasses. The volumes were then equalized to those containing 0.5 cc. by the addition of appropriate amounts of saline following which 0.5 cc. of the infectious material was added to each.

PREPARATION OF IMMUNE SERA

Guinea pigs.—Immune sera were obtained by several subcutaneous injections of guinea pigs with killed rickettsiae followed by living organisms. These suspensions were from mouse spleens in the case of the killed culture while the living cultures were from both mouse and guinea pig spleens. Bleedings were made from time to time and the serum tested for agglutinating properties. In table 5 are shown the results of an agglutination test with sera from guinea pigs after two subcutaneous inoculations of vaccine followed by three subcutaneous inoculations of suspensions of living rickettsiae.

TABLE 5.—*Results of agglutination test in guinea pigs after five inoculations*

Serum from guinea pig No.	1:10	1:20	1:40	1:80	1:160	1:320	1:640	1:1280
384	4	4	4	4	3	2	1	0
393	4	4	4	4	4	4	3	1
396	4	4	4	4	4	4	4	1

In table 6 is shown an agglutination test with several guinea pig sera after the above course of treatments and two additional inoculations of living rickettsiae.

TABLE 6.—*Results of agglutination tests after seven inoculations*

Serum from guinea pig No.	1:20	1:40	1:80	1:160	1:320	1:640	1:1280	1:2560	1:5120	1:10240
388	4	4	4	4	4	4	4	4	3	3
405	4	4	4	4	4	4	4	4	4	3
412	4	4	4	4	4	4	4	2	0	0

In the first test the animals were bled 10 days after the last inoculation of rickettsiae and in the second test 12 days after the last inoculation.

Rabbits.—Three rabbits which had previously received intravenously suspensions of killed rickettsiae (7, 12, and 18 inoculations) with titers not exceeding 1:640 were given three subcutaneous inoculations of suspensions of live rickettsiae at intervals of from 9 to 11 days, using 1 cc., 2 cc., and 4 cc. The results obtained in the agglutination test on bleeding 12 days after the last inoculation are shown in table 7.

TABLE 7.—*Results of agglutination test after intravenous and subcutaneous inoculations*

	1:20	1:40	1:80	1:160	1:320	1:640	1:1280	1:2560	1:5120	1:10240
NM1	4	4	4	4	4	4	4	4	3	2
NM2	4	4	4	4	4	4	4	4	3	2
Q	4	4	4	4	4	4	4	3	2	0

TESTS FOR PASSIVE IMMUNITY IN GUINEA PIGS WITH HYPERIMMUNE SERA

In figure 5 are shown the results of a test using immune guinea pig serum pooled from blood drawn from 7 guinea pigs which had received two inoculations of killed culture and five of living rickettsiae, and which were bled 12 days after the last inoculation. Tests were made in duplicate using plasma from a guinea pig inoculated with the "M" strain. With the exception of 1 or 2 days' elevation in temperature in 2 of the animals all dilutions of the immune serum, including the 0.01 cc. dose, protected against 0.5 cc. of the infected guinea pig plasma. Control animals without immune sera ran temperatures typical of "Q" fever.

Another similar test was carried out with the same hyperimmune serum against the "X" strain. There were certain irregularities in this test. While complete neutralization was indicated by no rise in temperature with the 0.2 cc. amount of serum and the 0.02 cc. and with one of the 0.01 cc. amounts, all others showed a slight delayed elevation in temperature. Apparently the late elevation of temperature is evidence of incomplete neutralization.

Figure 6 shows the results of another test using immune guinea pig serum pooled from blood drawn from 4 guinea pigs after 8 inoculations of killed and living suspensions of rickettsiae, the first 7 corresponding with those in the preceding test. This was followed in 19 days with an inoculation of a heavy suspension of killed culture. Twelve days afterwards the animals were bled. Plasma from a guinea pig infected with the "X" strain of "Q" fever was mixed with the various dilutions of immune sera, using the same dilutions

of the latter as in the previous test. In this test less protection was afforded and a "zone phenomenon" was in evidence, since there was less neutralization with 0.5 cc. and 0.2 cc. of immune sera than with smaller amounts, although the smallest amount used, 0.01 cc., was probably not sufficient to afford complete protection.

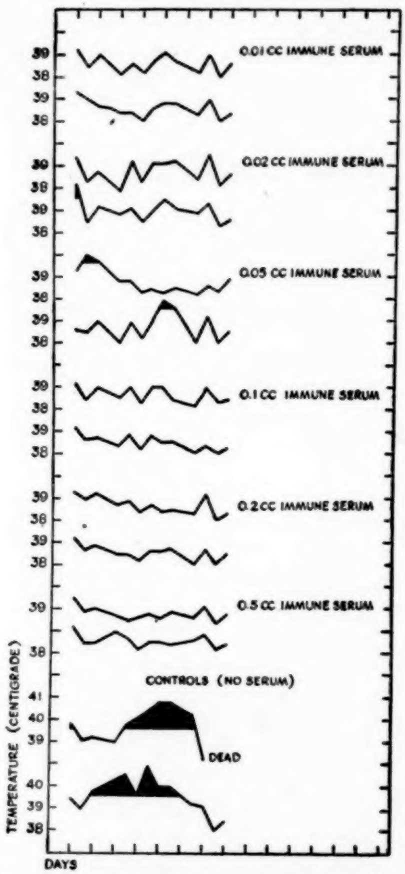

FIGURE 5.—Test for passive immunity in guinea pigs using guinea pig hyperimmune serum and plasma from a guinea pig infected with the "M" strain.

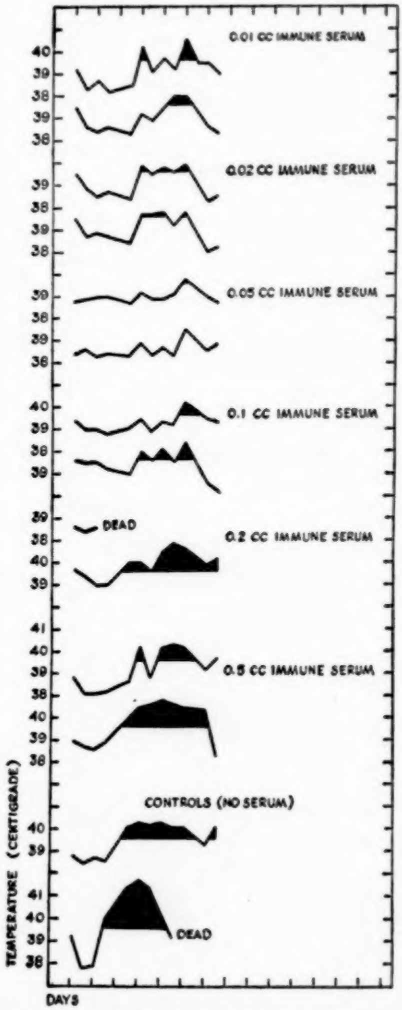

FIGURE 6.—Test for passive immunity in guinea pigs using guinea pig hyperimmune serum and plasma from a guinea pig infected with the "X" strain.

This same immune serum was similarly tested against plasma from a guinea pig inoculated with the "M" strain. Again there was less neutralization with the 0.5 cc. amount of immune serum and also with the 0.2 cc. amount than with the smaller amounts of 0.1 cc. and 0.05 cc. Temperature elevations occurred as early in these

as in the control animals without immune serum. With the two smallest amounts, 0.02 cc. and 0.01 cc., there was some protection

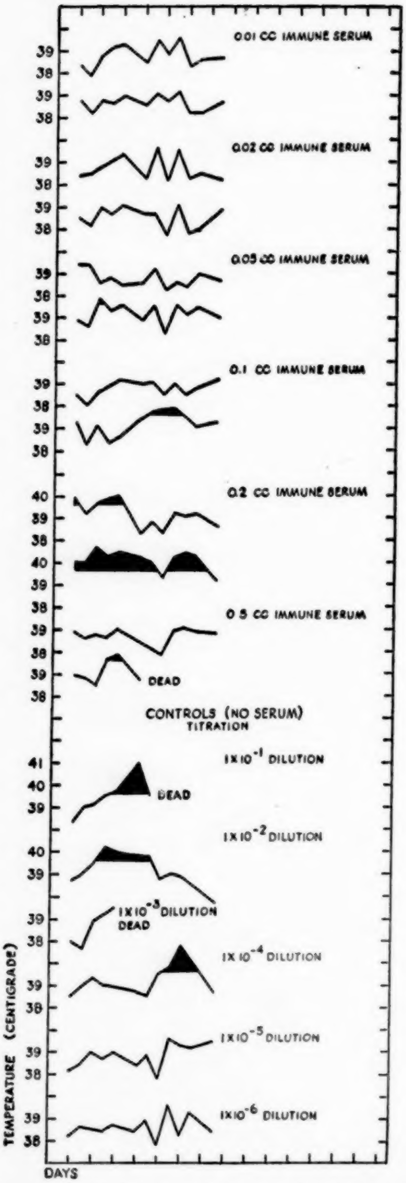

FIGURE 7.—Test for passive immunity in guinea pigs using rabbit hyperimmune serum and suspension of spleen and liver from a guinea pig infected with the "M" strain.

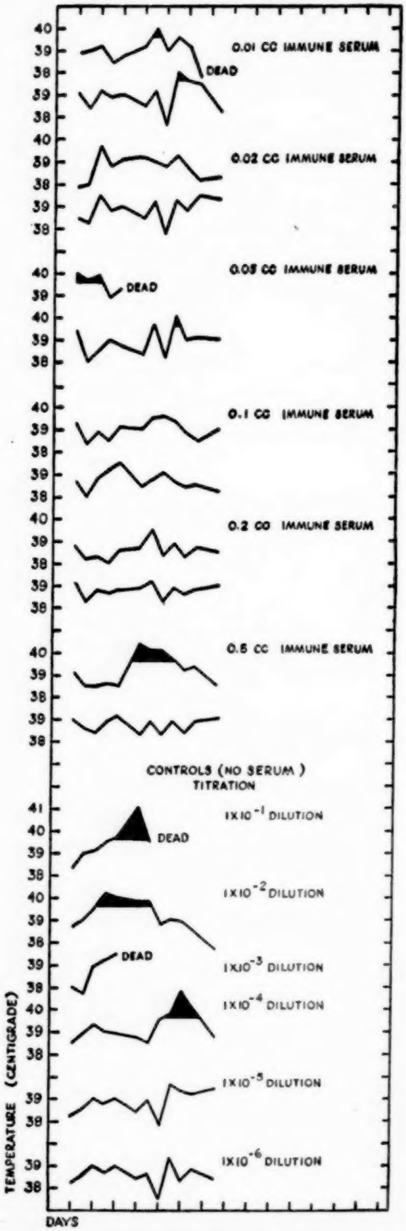

FIGURE 8.—Test for passive immunity in guinea pigs using guinea pig hyperimmune serum and suspension of spleen and liver from a guinea pig infected with the "M" strain.

as compared with the controls, but evidently there was a decline in the neutralizing power with these doses.

The greater degree of protection in the first test than in the second and third tests calls for explanation. Although the immune serum used in the second and third tests was obtained from animals that had received an additional inoculation of rickettsiae (a heavy suspension of killed rickettsiae), the protection afforded was less. However, the suspension of killed rickettsiae was not inoculated until 19 days following the last inoculation of live culture, and bleeding followed this in 12 days. The protective antibodies may have declined in the interval between the last inoculation with the living rickettsiae and may not have been reinforced following the inoculation of the killed organisms, although this was a very heavy suspension. On the other hand, the infective plasma may have been more potent. No titration was made of these two sera.

Figures 7 and 8 show the results obtained with hyperimmune guinea pig and rabbit serum against a 10 percent suspension of macerated spleen and liver from a guinea pig infected with the "M" strain.

With the rabbit serum (fig. 7) protection was afforded with the smallest amount used, 0.01 cc. The elevations of temperature in the animals inoculated with the mixture containing 0.2 cc. of immune serum were probably due to secondary infections, as the rise in temperature began the day following inoculation. One of the animals receiving 0.5 cc. of the serum showed a slight elevation of temperature on the fifth day and died on the seventh day.

The hyperimmune guinea pig serum (fig. 8) afforded complete protection with 0.02 cc. Partial protection was afforded by 0.01 cc. A secondary infection probably accounted for the elevation of temperature beginning the day following inoculation and the death of one of the animals inoculated with the mixture containing 0.05 cc. of serum. A rise in temperature lasting 1 day occurred in the other animal inoculated with the same mixture. Again one of the animals receiving the mixture containing 0.5 cc. of the serum ran an elevated temperature for 4 days. Transfers from this animal were made on the third day of temperature. These animals had elevations of temperature characteristic of "Q" fever, proving the lack of neutralization of the infected tissue suspension by the hyperimmune serum.

The titration of the suspension of infected spleen and liver used in these tests indicate a minimal infective dose of 1×10^{-4} cc. On this basis, 1 cc. of the hyperimmune rabbit serum neutralized 500,000 minimal infective doses of the spleen and liver suspension of the infected guinea pig. One cc. of the hyperimmune guinea pig serum protected against 250,000 minimal infective doses.

TESTS FOR PASSIVE IMMUNITY IN GUINEA PIGS WITH GUINEA PIG CONVALESCENT SERA

Tests were also made using sera from recovered guinea pigs instead of hyperimmune serum. In one such test the animal had been inoculated with 2 cc. of blood from an infected guinea pig 34 days before bleeding. Fever began on the fifth day and continued through the eighth day. The blood was, therefore, drawn 29 days after the beginning of fever.

Agglutination of a suspension of "Q" fever rickettsiae was obtained in a dilution of 1:80 of this serum (1:10, 4+; 1:20, 4+; 1:40, 3+; and 1:80, 2+).

In the test for passive immunity with this serum the same dilutions of serum from the recovered guinea pig were mixed with 0.5 cc. of plasma of an infected animal as in the previous tests. The infected animal had fever on the sixth to the eighth day after inoculation and blood was drawn on the eighth day.

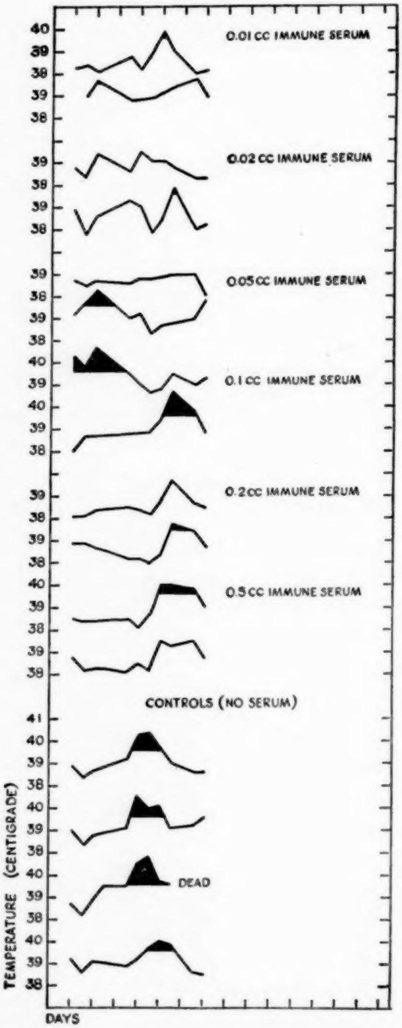

FIGURE 9.—Test for passive immunity in guinea pigs using guinea pig convalescent serum and plasma from a guinea pig infected with the "X" strain.

Figure 9 shows the results of this test. All four of the controls without convalescent sera had elevated temperatures beginning on the seventh or eighth day after inoculation and continuing for 3 days. Protection was afforded by all the dilutions of convalescent sera used, though as in the former tests there was a tendency for the animals receiving the larger amounts of convalescent serum, particularly one of the two animals receiving the 0.5 cc. amount, to show less neutralization as indicated by the longer period of fever in one of the animals receiving this amount. In one or both of each pair receiving the doses below 0.5 cc., except in the case of the pair receiving 0.05 cc. of the convalescent serum, there was a slight late elevation in temperature indicating partial neutralization.

In the titration of the plasma from the infected guinea pig used in this test there was definite evidence of typical "Q" fever temperature elevation in the animal receiving the 1×10^{-1} dilution. The animal receiving the 1×10^{-2} dilution showed no rise in temperature, while those receiving 1×10^{-3}, 1×10^{-4}, and 1×10^{-5} had 1 or 2 days late rise in temperature. There is a question, therefore, as to the true end-point. Though the results are clear cut when the controls receiving 0.5 cc. of virus plasma are considered, they are less so when the titration of the virus plasma is considered. On the basis of a minimal infective dose of 1×10^{-1} cc., 1 cc. of the convalescent serum neutralized 500 minimal lethal doses.

DISCUSSION

Rickettsial active and passive immunity in experimental animals as exemplified by "Q" fever follows in general the same laws as those which apply in bacterial active and passive immunity. Active immunity results when the disease has run its course in the animal or when killed organisms are introduced into the body. Evidence of immunity is found in resistance to reinfection with the disease, in the development of agglutinating antibodies and neutralizing antibodies. Sera from animals which have recovered from the disease or which have received killed cultures confer passive immunity when mixtures of the immune serum and the infecting agent are inoculated into animals.

The questions of the time when immunity begins, the duration of immunity, and the matter of the relationship of the various antibodies resulting from the disease or from artificial immunity, are the same as those which arise in bacterial immunity.

Active immunity can be readily produced in experimental animals by the use of killed rickettsial vaccines. Such vaccines immunize in suspensions as low as 2½ percent (1/40 dilution) of the original tissue, or probably lower. By the use of infected yolk sac of high titer for the inoculation of mice and guinea pigs the number of rickettsiae in the spleens and livers of mice and guinea pigs may be increased and these infected spleens and livers are suitable and convenient material for the preparation of vaccines. Protection was afforded in guinea pigs against 10,000 to 10,000,000 infectious doses of such vaccines.

Hyperimmune sera may be produced in guinea pigs and rabbits by inoculation of killed cultures followed by living organisms. Repeated inoculations of killed cultures by the intravenous route in rabbits failed to raise the titer of the serum above 1:640. By several added subcutaneous inoculations of living organisms the titer was raised to 1:10,240.

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Tests for passive immunity in guinea pigs with hyperimmune rabbit and guinea pig sera demonstrated neutralization of 250,000 to 500,000 minimal infectious doses by 1 cc. of hyperimmune serum.

Tests for passive immunity in guinea pigs with convalescent guinea pig serum gave evidence of protection against 500 minimal infectious doses.

The "zone phenomenon" observed in the neutralization tests described raises the question of the factors responsible for this discrepancy, there being less neutralization in a number of tests with the larger amounts of serum employed than with the smaller amounts. This was observed with both the hyperimmune and the convalescent sera. It seems possible that this effect was related to the presence or absence of saline in the mixtures. As prepared there was no saline in the mixture containing the largest amount of immune serum. It would appear that the presence of a certain amount of saline is conducive to the neutralization of the virus by the immune serum. This is probably related to the phenomenon of dissociation of virus-antiserum mixtures in influenza as described by Burnet (*9*). In view of the fact that in all the tests made there was evidence of neutralization with amounts as small or smaller than 0.1 cc. it would seem desirable that neutralization tests be carried out with mixtures containing a certain amount of saline.

SUMMARY

Vaccines were prepared from the spleens and livers of mice and the spleens of guinea pigs inoculated with high titer "Q" fever infected yolk sac suspensions. Vaccines prepared from 2½ percent suspensions of such infected tissue immunized guinea pigs against 10,000 to 10,000,000 minimal infective doses.

Hyperimmune sera were produced in guinea pigs and rabbits by the inoculation of killed cultures followed by live cultures. These agglutinated suspensions of "Q" fever rickettsiae in dilutions up to 1:10,240.

Tests for passive immunity in guinea pigs were made using hyperimmune sera and convalescent sera from guinea pigs. Hyperimmune sera neutralized up to 500,000 minimal infective doses and convalescent serum neutralized 500 minimal infective doses.

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THE EFFECT OF SODIUM SELENITE ON THE BLOOD SUGAR AND LIVER GLYCOGEN OF RATS AND RABBITS [1]

By C. I. Wright, *Pharmacologist, United States Public Health Service*

Jones (*1*) stated that sublethal doses of sodium selenite caused a disappearance of glycogen from the liver of the rat. He did not determine the glycogen quantitatively and apparently neglected the fact that rats receiving large doses of selenite fail to eat and might deplete their liver glycogen by that means alone. Fillippi (*2*) observed a marked glycosuria in rabbits chronically poisoned with selenate and a slight glycosuria when given selenite. He found no evidence of hyperglycemia. Levine and Flaherty (*3*) found that acutely toxic doses of sodium selenite caused a hypoglycemia in fasted rabbits and also stated that the glycogen of the liver suffered a decrease due to the selenite. Pellegrino and Gaizzone (*4*) observed an increase in the blood sugar of fasted rabbits after intramuscular injection of selenate.

In view of the above apparent contradictions as to the effect of selenium on blood sugar and the inadequacy of the data on the effect of selenium on liver glycogen, determinations were made on the blood sugar of fasted and well-fed rats and rabbits and the liver glycogen of rats after injection of sodium selenite. Interest in the subject arose from the finding (*5*) that selenium causes an increase in the aerobic glycolysis of liver slices.

METHODS

The glycogen determinations were made by the method of Good et al. (*6*), using approximately 0.8 gram of liver cut from the central lobe. The liver was digested at approximately 100° C. in 2.0 cc. of 30 percent KOH for 30 minutes or more and the glycogen precipitated with 3 cc. of alcohol. The precipitate was dissolved in water, reprecipitated with alcohol, and then hydrolyzed in normal H_2SO_4 for 2 hours at 100° C. After neutralization to phenol red and suitable

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dilution, the glucose was determined by the method of Shaffer and Somogyi (7) using the reagent containing 1 gram of KI. Control determinations on samples of known glucose concentration were always made and blank analyses were run with each series of determinations.

The rat blood sugar determinations were made on 1.0 cc. of blood collected on decapitation and, before coagulation, added to 8 cc. of 1.25 percent zinc sulfate solution, precipitated with 1.0 cc. of 0.75 N NaOH, filtered, and the filtrate analyzed for glucose by the Shaffer-Somogyi (7) procedure. Determinations of the rabbit blood sugar were made on 0.5 cc. of blood collected from the marginal ear vein with a few crystals of lithium oxalate to prevent coagulation. The 0.5 cc. of blood was precipitated with 4 cc. of $ZnSO_4$ solution plus 0.5 cc. of 0.75 N NaOH, centrifuged, and the supernatant fluid analyzed for glucose. Duplicate blood sugar determinations were always made if the amount of glucose-containing solution allowed.

The rabbits were on a stock diet of Purina rabbit chow plus cabbage, and the rats were fed diet 242 (8) previous to the experimental period.

RESULTS

Figure 1 shows the values (mg. percent) obtained for the blood sugar of well-fed rats after intravenous injection of sodium selenite at the dosages given. The selenite was dissolved in water at a concentration of 2 to 4 mg. per cc. and a volume of 0.2 to 0.6 cc. injected. Fifteen control animals injected with 0.9 percent of NaCl had an average blood sugar of 106 mg. percent with a variation between 94 and 115 mg. percent. Doses of 5.0 or more mg. per kg. of sodium selenite caused a definite increase in blood sugar within a period of 2 to 4 hours after injection.

TABLE 1.—*The effect of sodium selenite on the liver glycogen concentration of the rat*

Animals	Na_2SeO_3 mg./kg.	Injected	Killed	Glycogen range, grams percent	Glycogen average, grams percent
4	7.0	9:58–10:08	1:00– 2:12	4.2–5.9	5.1
4	Controls		1:00– 2:15	4.5–5.7	5.2
2	10.0	9:52– 9:58	12:27–12:32	1.7–2.5	2.1
5	12.0	9:47– 9:55	12:12– 1:07	2.2–4.9	3.9
6	Controls		12:00 - 1:00	4.2–5.8	5.3

The livers of the animals receiving 7, 10, and 12 mg. per kg. of selenite were analyzed for glycogen and the results are included in table 1, as grams of glycogen per 100 gm. of wet liver. Seven mg. per kg. of selenite caused no change in the liver glycogen concentration 3 to 4 hours after the injection. Ten and 12 mg. per kg., however, definitely decreased the liver glycogen in 6 of the 7 animals

injected. Diselenodiacetic acid was also injected into a small group of rats over a dose range of 20 to 50 mg. per kg. without measurably changing the liver glycogen concentration, although the blood sugar was raised slightly (130–150 mg. percent).

Figure 2 shows the typical effects of sodium selenite on the blood sugar of well-fed rabbits at various periods after a subcutaneous injection. The blood sugar as mg. percent is plotted against the time in hours after the injection. Doses above 3 mg. per kg. were rapidly fatal to the animals and the time of death is indicated by the symbols along the abscissa. Two mg. per kg. of selenite never caused a rise or

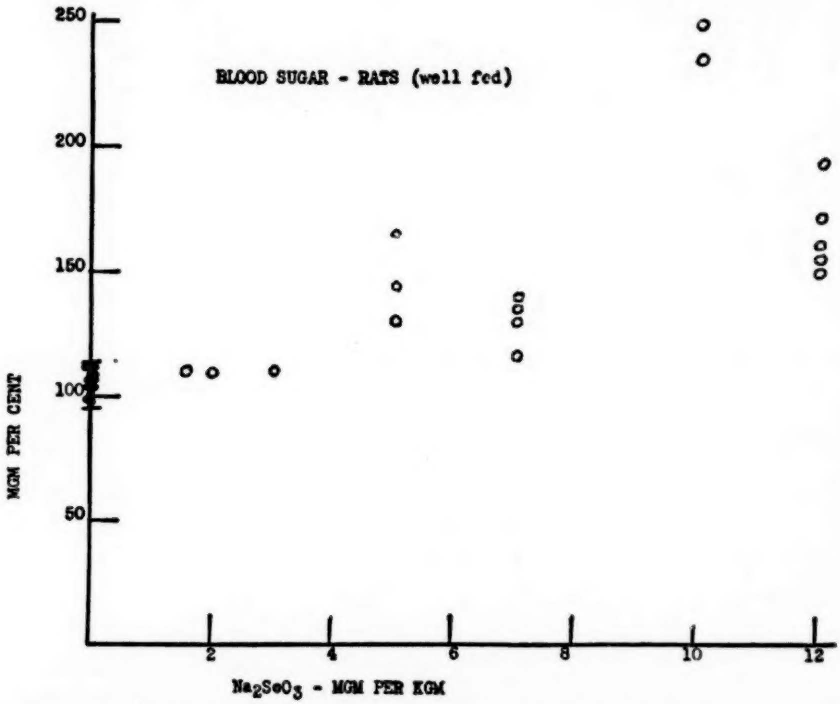

FIGURE 1.—The concentration of glucose in the blood of the white rat (Wistar) after intravenous injections of sodium selenite.

fall in the blood sugar. Three mg. caused a transient rise in blood sugar in some animals but had no effect on others. Above 3.0 mg. per kg. a marked hyperglycemia was always observed, reaching values of 400 to 600 mg. percent and terminating in the death of the animal. At any one dose the rate of rise and the maximum reached varied considerably but no decrease in blood sugar was ever noted at any dose administered. Figure 3 shows the typical effects of subcutaneous injections of sodium selenite into rabbits that had previously been fasted for 24 hours. In contrast to the fed animals the blood sugar rises only slightly at doses of 4 or 5 mg. per kg. A fall in blood sugar

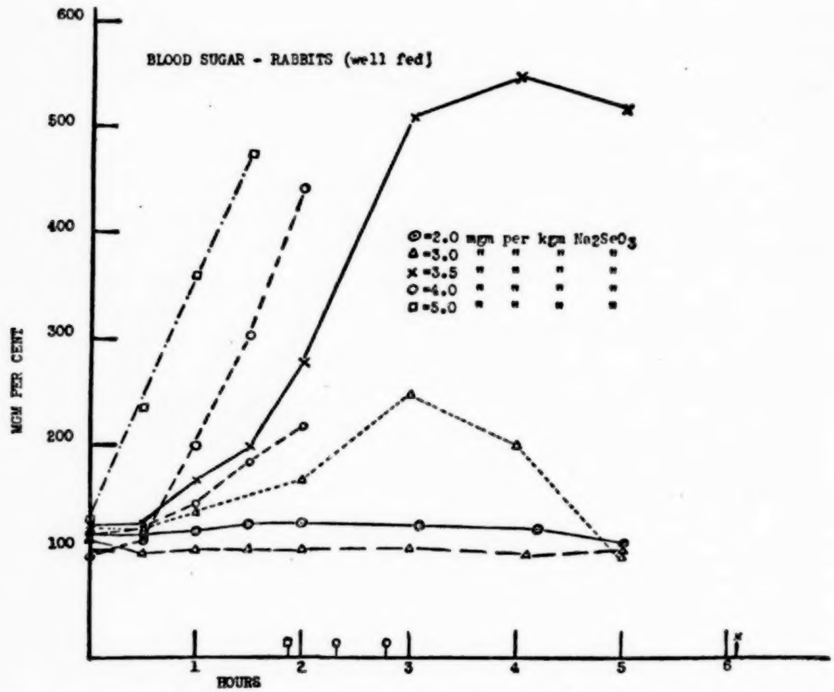

Figure 2.—The blood sugar concentrations of well-fed rabbits after subcutaneous injections of sodium selenite. The symbols on the abscissa indicate the time of death of the animal.

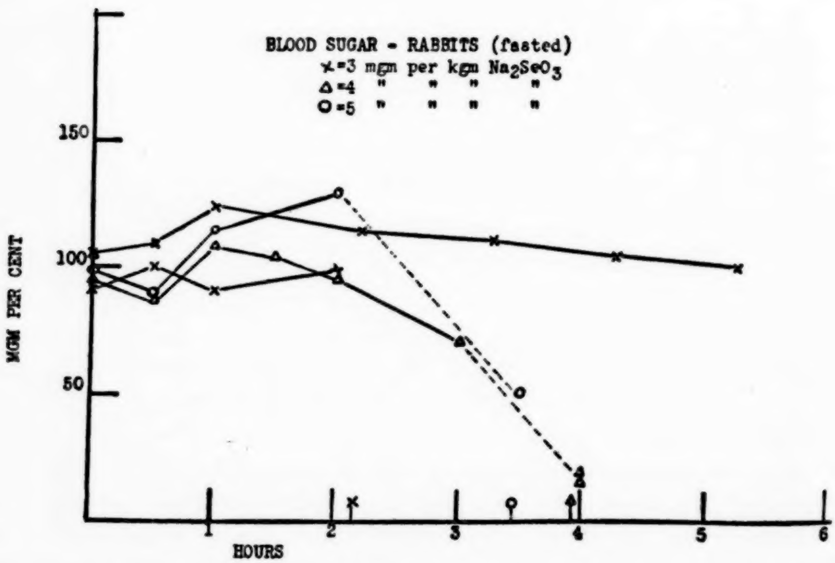

Figure 3.—The blood sugar concentrations of fasted (24 hours) rabbits after subcutaneous injections of sodium selenite. The symbols on the abscissa indicate the time of death of the animal. The last samples at 4 and 5 mg. per kg. were taken from the heart at the death of the animal.

sometimes followed large doses when the animal was in a practically moribund condition and a hypoglycemia was always found when the blood was drawn from the heart of the animal at death. The last two

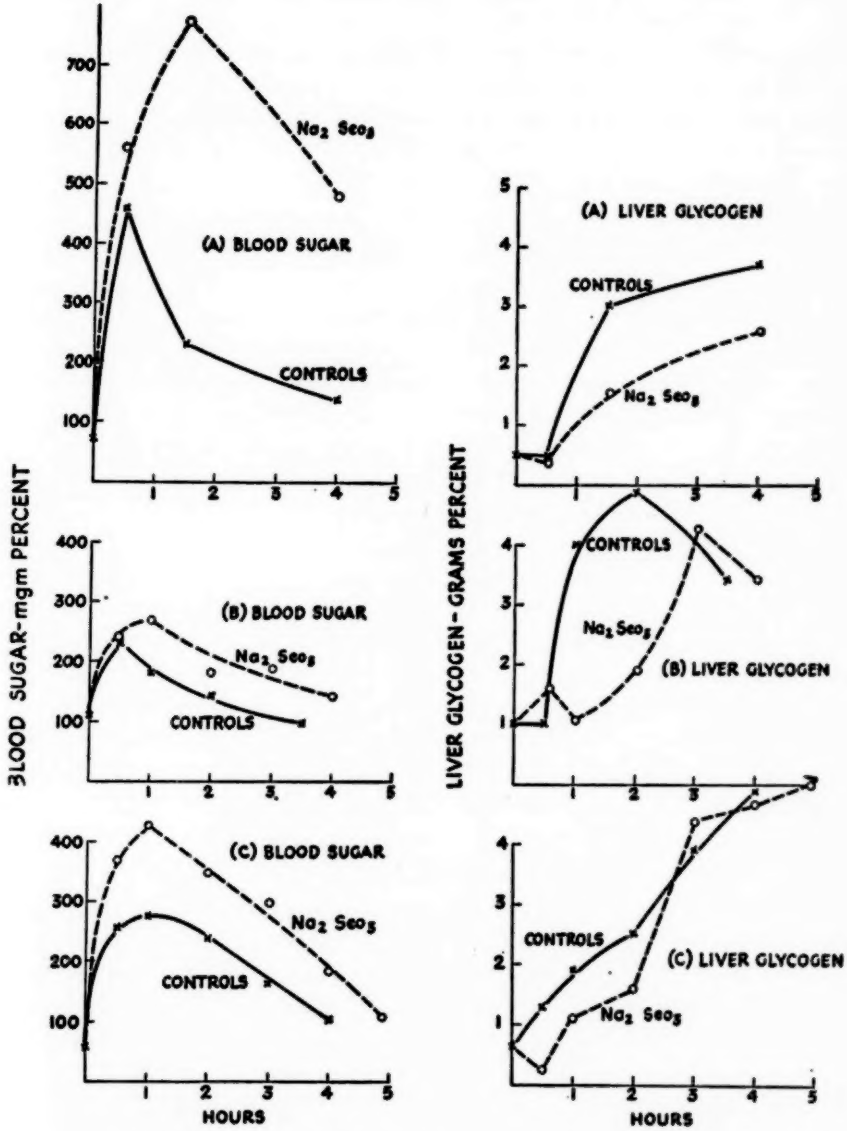

FIGURE 4.—The blood sugar and liver glycogen concentrations of fasted rats after subcutaneous injections of glucose and intravenous injections of sodium chloride (controls) or 5 mg. per kg. of sodium selenite. The solid lines represent the control animals and the broken lines the animals that received selenite.

values on the curve representing 4 mg. per kg. and the last value on the curve representing 5.0 mg. per kg. were taken from the hearts of the animals while they were dying. One rabbit survived a 3.0-mg. dose

until the day following the injection (26 hours) when a sample of blood from the ear vein gave a value of 6.5 mg. percent glucose. Two samples taken from the heart of the same rabbit one-half hour later (at death) gave values of 3.5 and 4.0 mg. percent. Blood taken from two other animals that survived doses of 2.5 mg. per kg. showed no decrease in blood sugar the day following the injection, beyond what would be expected from a prolonged fasting period.

In order to determine whether selenite interfered with the deposition of glucose as glycogen in the liver, a series of experiments was made on fasted rats receiving subcutaneous injections of glucose with and without the intravenous injection of sodium selenite. Groups of 8 to 13 fasted rats of one sex were first injected with selenite or 0.9 percent sodium chloride (controls) and then all but one animal received a subcutaneous injection of glucose. The animal receiving neither selenite nor glucose was killed for determination of initial blood glucose and liver glycogen. The remaining animals were then killed in pairs at desired intervals and the blood sugar and liver glycogen determined. The results of three such experiments are given in graphic form in figure 4. All three groups received 5 mg. per kg. of sodium selenite or an equivalent volume of sodium chloride (controls). Group A (males) was fasted for 48 hours and given 5.0 cc. of a 15-percent glucose solution. Group B (females) was fasted 24 hours and given 4.0 cc. of a 12-percent glucose solution. Group C (males) was fasted 48 hours and received an injection of 4.2 cc. of a 12-percent glucose solution.

The graphs to the left of figure 4 show the increase in blood sugar due to the absorbed glucose. In each series the blood sugar reached a higher maximum and returned to normal levels more slowly when the animals had received an intravenous injection of sodium selenite. The graphs to the right of figure 4 show the rate of deposition of glycogen in the livers of the same animals. In each experiment the glycogen was deposited more slowly in the animals receiving the selenite. The delay was limited, however, to the first 3 hours, except in the first experiment. The animals apparently recover the ability to form glycogen quite rapidly after an initial interference with the mechanism for glycogenesis.

DISCUSSION

It is evident that toxic doses of sodium selenite cause an increase in the blood sugar concentration of well-fed rats and rabbits. Lethal doses also measurably decrease the liver glycogen of the rat and presumably this is the source of the glucose in the blood. With the evidence that selenite causes an increase in the *in vitro* aerobic glycolysis of liver slices from well-fed rats (*5*), it appears that selenium acts directly on the glycogenolytic mechanism to speed up the hydrolysis of glycogen to glucose and other oxidizable substrates.

The fasted rabbits showed no such increase in blood sugar as the fed animals and sometimes, as found by Levine and Flaherty (*3*), a decrease was observed but only when the animal was in a semi-moribund condition.

Potter, Dubois, and Moxon (*9*) have recently reported that the ingestion of seleniferous wheat causes a decrease in the liver glycogen storage. The livers of their control animals, however, were low in glycogen and the decrease noted in the experimental animals might have been due to decreased food intake since they suffered from inanition and loss of weight. A series of determinations were made by the author on the livers of rats which had been used for comparison of the effect of diet on selenium toxicity (*10*). These rats were on diets 25 and 30, composed principally of seleniferous (20 p. p. m. selenium) and nontoxic wheat (*10*). Eight male animals on diet 25 had an average liver glycogen concentration of 4.6 gm. percent while the control animals had a concentration of 6.8 gm. percent. The figures are not given in detail, nor considered very significant, since it was known that the experimental animals did not eat as well and that a short period of fasting has a marked influence on the liver glycogen stores in the rat. It seems necessary to match the food intake of the experimental and control animals to decide whether chronic selenosis decreases liver glycogen, and even then the time of food ingestion in relation to removal of the liver would be a factor contributing to the results found.

SUMMARY

Intravenous doses of sodium selenite greater than 5.0 mg. per kg. cause an increase in the blood sugar concentration of the rat and 10.0 mg. per kg. cause a measurable decrease in liver glycogen.

Subcutaneous doses of sodium selenite greater than 3.0 mg. per kg. cause a marked rise in the blood sugar concentration of well-fed rabbits. The same doses sometimes cause a slight rise in the blood sugar of the fasted rabbit, followed occasionally by an abrupt fall preceding the death of the animal.

Fasted rats have a lower glucose tolerance when injected with sodium selenite and the rate of deposition of liver glycogen from the injected glucose is slowed for 2 or more hours.

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NEW EDUCATIONAL FILM TO AID NUTRITION CAMPAIGN

As a contribution to nutrition education, the United States Public Health Service recently cooperated in the production of a motion picture entitled "Proof of the Pudding," designed primarily to acquaint the public with the importance of the right choice of food in maintaining health.

The picture presents important nutritional knowledge in an effective manner. Scenes in a nutrition laboratory emphasize the fact that our knowledge of the dietary needs of human beings is based on scientific research. An animated chart shows the foods needed for energy, building and repair of the body, the maintenance of body processes, and protection against disease. It is pointed out that these foods form the nutritional basis for good health, and that when any one of them is withheld or used in too small an amount, disease or conditions of subnormal health result.

The results of specific dietary deficiencies are demonstrated in animals. A typical healthy family reveals the result of proper nutrition, while the important specific indications of good nutrition are emphasized by a physical examination in a doctor's office. The buoyant health of the children is credited to the mother, who provided them an excellent start in life by observing a proper dietary before they were born and continuing to provide the right kind of food as they grew up. The initial scene in a zoo kitchen contrasts the scientific feeding of the animals with the unscientific method of many families.

The Surgeon General has recently pointed out that proper nutrition is the first requirement of good health. Recent research, in the laboratory and in the field, has not only revealed that a large part of our population is suffering from dietary deficiencies which result in manifest disease or lowered physical resistance, but has resulted in knowledge of means of correcting those conditions through proper diet.

"Proof of the Pudding" is a technicolor, 10-minute sound film, professionally produced, and should be a valuable supplement to

radio programs and published material on nutrition. For the time being it will be shown only in the commercial theaters, to which it is made available without cost. State health officers are cooperating in having it presented in their States in connection with State-wide nutrition education programs.

Further information regarding prints and publicity material may be had from the Welfare Division, Metropolitan Life Insurance Co., New York, N. Y., with which the Public Health Service cooperated in producing the film.

STUDY OF EFFECTS OF KETONE VAPOR INHALATION [1]

The work reported is concerned with acute effects on guinea pigs. Data were collected on effects on cornea and conjunctiva, buccal, nasal, and pharyngeal mucosae, central nervous system, circulatory system, etc. The general summary follows:

1. The inhalation of vapors of dimethyl, methyl ethyl, methyl propyl, methyl n-butyl, methyl iso-butyl, methyl n-amyl, and methyl n-hexyl ketone and acetonylacetone, cyclohexanone, and methyl iso-butenyl ketone by guinea pigs produces a progressive general narcosis characterized by the depression of the body temperature, the respiratory rate, and the heart rate, as well as the abolition of corneal, auditory, and equilibratory reflexes.

2. The depression of the various bodily functions is directly proportional to the concentration of the inhaled vapor, to the duration of the exposure, and, in the homologous series of straight-chain methyl ketones, to the number of carbon atoms in the chain. Respiratory and cardiac hyperfunction have been observed in cyclohexanone and methyl iso-butenyl ketone only during moderate and low concentrations in the stage following reflex depression.

3. The degree of depression of the various bodily functions is most closely paralleled by the partition coefficient of ketone in oil over water, methyl iso-butenyl ketone and acetonylacetone excepted.

Modifications in the molecular structure other than extension of the carbon chain are concomitant with relatively unpredictable narcotic strengths.

4. The inhalation of ketone vapors in concentrations that irritate the mucosae of the naso-pharyngeal region causes a transient reflex depression of the respiratory and heart rate. This phenomenon furnishes a limiting index for adequate warning properties during the inhalation of these ketones.

[1] Acute response of guinea pigs to the inhalation of ketone vapors. By A. Specht, J. W. Miller, P. J. Valaer, and R. R. Sayers. National Institute of Health Bulletin No. 176. Available from the Superintendent of Documents, Government Printing Office, at 15 cents per copy.

5. The pathology of acute exposure to ketone vapor by inhalation is characterized by a general congestion in guinea pigs due to central vasomotor disturbances. Long-continued exposures result in extravasations in the capillary beds, particularly in the lungs.

COURT DECISION ON PUBLIC HEALTH

Power of State board of health to make regulations concerning milk and other dairy products.—(Kansas Supreme Court; *State* v. *Reynolds*, 107 P.2d 728; decided December 7, 1940.) A person who was convicted in the lower court of violating certain milk regulations of the Kansas State Board of Health appealed to the supreme court, his principal contention being that the power to promulgate regulations relative to the production and sale of milk and other dairy products was vested by statute exclusively in the State board of agriculture. The numerous and comprehensive statutory provisions involved in the determination of the question were reviewed by the appellate court, it being pointed out that the board of health relied upon the broad powers conferred upon it in matters affecting the public health and particularly upon general provisions contained in the food and drug acts, while the board of agriculture stood upon the comprehensive statutes dealing specifically with the production, handling, and sale of milk and other dairy products. The court, for brevity, denominated these statutes as the food and drug acts and the milk acts, respectively.

The fundamental issue of jurisdiction as between authority conferred by the food and drug acts, general in character, and that conferred by the milk acts, particular and specific in character, was said to be directly raised for the first time, and the conclusion reached was that the legislature intended to place in the board of agriculture exclusive jurisdiction to regulate the production, manufacture, handling, and sale of milk and dairy products—except as hereinafter noted—and did not intend to subject those who were so regulated to dual supervision. "We think," said the court, "the situation clearly falls within the well-established rule of statutory construction that where a statute of a general nature and one of a particular or special nature are in conflict, the latter prevails over the former."

The exception to the conclusion that the milk acts had taken from the board of health regulatory power as to milk and other dairy products related to the subjects of adulteration and misbranding. These were dealt with minutely and comprehensively in the food and drug acts and there were no comparable provisions in the milk acts. The court concluded that, as to adulteration and misbranding, the board

of health could make regulations applicable to milk and other dairy products within the powers conferred upon it for such purpose. "Such regulations may relate only to the ingredients, the constituent elements, the character or nature of such products in order to safeguard the public health or to prevent deception, and may not otherwise relate to the sale, or to the production, manufacture or handling of them or to other matters subject to exclusive regulation by the State board of agriculture."

With reference to the counts upon which the appellant was convicted the supreme court held that certain of them were predicated upon regulations of the board of health which clearly related to matters within the exclusive jurisdiction of the board of agriculture and that the others were based upon regulations which, even though containing some possibly valid provisions, were invalid because inextricably tied up with requirements as to production, handling, etc.

The judgment of the lower court was reversed and the case remanded with directions to set aside the conviction and the sentence.

DEATHS DURING WEEK ENDED FEBRUARY 8, 1941

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Feb. 8, 1941	Corresponding week, 1940
Data from 88 large cities of the United States:		
Total deaths	10,193	10,030
Average for 3 prior years	9,505	
Total deaths, first 6 weeks of year	59,447	58,061
Deaths under 1 year of age	527	543
Average for 3 prior years	552	
Deaths under 1 year of age, first 6 weeks of year	3,342	3,305
Data from industrial insurance companies:		
Policies in force	64,686,023	66,294,279
Number of death claims	13,835	13,689
Death claims per 1,000 policies in force, annual rate	11.2	10.8
Death claims per 1,000 policies, first 6 weeks of year, annual rate	10.7	10.5

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED FEBRUARY 15, 1941

Summary

The decline in the incidence of influenza, which began with the week ended January 25, has continued during each of the succeeding weeks. For the current period, a total of 21,989 cases was reported, as compared with 38,241 for the preceding week. Each geographic division recorded a decrease in the number of cases reported, although slight increases were noted for a few States. The largest increase was reported in Arkansas, with 1,453 cases as compared with 767 cases for the preceding week.

Of the 9 communicable diseases included in the following weekly table, the incidence of measles alone was higher than for the preceding week, while only influenza, measles, and poliomyelitis were above the 5-year (1936–40) median. The accumulated totals to date of these diseases and of whooping cough were also above the 5-year cumulated medians. The current incidence of diphtheria, meningococcus meningitis, scarlet fever, smallpox, and typhoid fever is lower than that for the corresponding week of any of the preceding 5 years. Twenty-nine of the 47 cases of typhoid fever were reported from the South Atlantic and South Central States, and 32 of the 37 cases of smallpox occurred in the North Central States.

Three cases of undulant fever were reported in Mississippi, and 1 case each in Maryland and Indiana. Of 24 cases of endemic typhus fever, 9 occurred in Georgia and 4 in Florida.

For the current week, the Bureau of the Census reports 9,731 deaths in 88 major cities of the United States, as compared with 10,229 (corrected figure) for the preceding week and a 3-year (1938–40) average of 9,451. The crude death rates for 92 large cities for the corresponding periods were 13.6, 14.3, and 13.2 (88 cities).

Telegraphic morbidity reports from State health officers for the week ended February 15, 1941, and comparison with corresponding week of 1940 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported, cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended		Median 1936–40	Week ended		Median 1936–40	Week ended		Median 1936–40	Week ended		Median 1936–40
	Feb. 15, 1941	Feb. 17, 1940		Feb. 15, 1941	Feb. 17, 1940		Feb. 15, 1941	Feb. 17, 1940		Feb. 15, 1941	Feb. 17, 1940	
NEW ENG.												
Maine	0	3	1	112	7	8	122	217	87	0	0	0
New Hampshire	0	0	0	------	------	------	4	84	30	0	0	0
Vermont	0	0	0	------	------	------	29	2	7	1	0	0
Massachusetts	2	4	7	------	------	------	454	320	706	2	0	2
Rhode Island	1	0	1	1	------	------	0	96	58	0	0	0
Connecticut	0	0	0	90	3	12	84	108	122	0	0	0
MID. ATL.												
New York	15	26	35	[1] 182	[1] 43	[1] 69	3, 375	274	1, 048	8	4	9
New Jersey	7	12	12	704	30	30	1, 076	49	70	0	0	3
Pennsylvania	20	35	39	------	------	------	3, 189	74	204	4	20	9
E. NO. CEN.												
Ohio [2]	2	22	22	272	202	95	395	46	54	0	1	4
Indiana	12	17	24	113	596	220	222	5	10	2	0	1
Illinois	18	23	31	127	128	128	1, 995	18	26	1	0	0
Michigan [3]	5	6	10	120	31	12	1, 965	275	275	1	2	2
Wisconsin	1	4	1	731	112	70	769	165	165	0	0	0
W. NO. CEN.												
Minnesota	5	3	3	240	2	3	10	366	195	0	1	1
Iowa	7	3	7	321	86	27	162	174	100	1	0	2
Missouri	5	8	10	38	59	153	86	15	15	1	1	2
North Dakota	3	0	1	113	20	14	6	3	4	1	0	0
South Dakota	0	0	1	9	6	3	31	2	2	0	0	0
Nebraska	4	5	5	8	------	------	1	95	16	0	0	1
Kansas	3	11	11	105	32	32	230	479	26	0	5	1
SO. ATL.												
Delaware	0	1	1	------	------	------	110	1	34	0	0	0
Maryland [3]	7	3	11	349	131	131	60	2	214	4	3	3
Dist. of Col.	0	5	5	37	19	18	31	2	6	0	0	1
Virginia	6	19	17	4, 018	2, 395	------	1, 060	33	176	2	4	8
West Virginia [3]	7	6	7	1, 185	954	88	134	6	8	0	0	4
North Carolina [4]	12	17	17	529	121	93	257	109	109	0	0	1
South Carolina [4]	2	11	4	2, 217	1, 041	1, 041	64	6	13	0	1	1
Georgia [4]	4	7	11	919	486	486	248	405	161	1	1	2
Florida [4]	4	5	5	220	50	18	58	55	53	0	0	0
E. SO. CEN												
Kentucky	4	9	13	396	136	136	599	42	70	2	2	13
Tennessee	13	8	9	533	677	245	155	108	108	7	4	4
Alabama [4]	7	8	14	1, 698	942	686	140	148	148	3	1	5
Mississippi [3]	5	6	5	------	------	------	------	------	------	0	0	2
W. SO. CEN.												
Arkansas	8	5	9	1, 453	1, 555	219	38	16	16	0	2	2
Louisiana [4]	4	6	13	168	342	48	8	3	11	0	2	2
Oklahoma	4	11	8	395	655	217	7	3	6	0	0	2
Texas [4]	22	41	56	2, 545	4, 543	983	518	304	228	2	3	6
MOUNTAIN												
Montana	6	3	1	51	4	18	6	38	38	0	0	0
Idaho	0	0	0	93	------	6	8	26	26	0	0	0
Wyoming	0	1	0	103	5	1	20	34	3	0	0	0
Colorado	12	13	13	78	27	------	106	34	34	0	3	0
New Mexico	6	1	2	94	4	4	136	5	42	1	0	0
Arizona	5	0	1	211	259	157	0	20	21	0	4	2
Utah [3]	2	0	0	114	10	------	31	203	81	0	0	0
Nevada	0	------	------	------	------	------	2	------	------	0	------	------
PACIFIC												
Washington	5	2	1	21	3	3	93	664	174	0	1	1
Oregon	1	8	2	37	70	70	193	351	27	1	0	0
California	20	20	28	[5] 1, 239	771	771	98	374	374	0	2	4
Total	276	398	524	21, 989	16, 557	9, 077	18, 385	5, 859	7, 872	45	67	102
7 weeks	2, 116	3, 026	4, 086	516, 438	98, 737	27, 772	89, 312	31, 841	39, 543	309	265	654

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended February 15, 1941, and comparison with corresponding week of 1940 and 5-year median—Continued

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median 1936–40	Week ended		Median 1936–40	Week ended		Median 1936–40	Week ended		Median 1936–40
	Feb. 15, 1941	Feb. 17, 1940		Feb. 15, 1941	Feb. 17, 1940		Feb. 15, 1941	Feb. 17, 1940		Feb. 15, 1941	Feb. 17, 1940	
NEW ENG.												
Maine	0	0	0	7	26	23	0	0	0	0	0	0
New Hampshire	0	0	0	4	4	6	0	0	0	0	0	0
Vermont	0	0	0	14	12	12	0	0	0	0	0	0
Massachusetts	0	0	0	125	146	252	0	0	0	0	1	2
Rhode Island	1	0	0	3	11	19	0	0	0	0	0	0
Connecticut	0	0	0	48	92	92	0	0	0	0	1	1
MID. ATL.												
New York	3	1	0	409	750	771	0	0	0	2	4	4
New Jersey	0	0	0	275	466	204	0	0	0	1	0	1
Pennsylvania	0	2	0	320	370	525	0	0	0	2	2	4
E. NO. CEN.												
Ohio	0	0	0	90	419	419	0	0	1	2	1	1
Indiana	0	0	0	179	236	231	1	0	2	3	8	2
Illinois	2	1	1	445	524	657	7	0	21	2	3	3
Michigan [3]	1	0	1	182	290	538	3	0	3	0	2	2
Wisconsin	2	3	0	115	170	284	4	10	5	0	0	0
W. NO. CEN.												
Minnesota	1	1	0	51	109	151	8	7	8	0	1	1
Iowa	1	1	0	75	59	142	1	6	29	0	1	1
Missouri	0	0	0	87	80	170	2	9	9	1	0	1
North Dakota	0	0	0	26	21	42	0	0	1	0	2	1
South Dakota	0	0	0	21	30	30	0	3	3	0	0	0
Nebraska	0	0	0	27	18	90	0	0	6	0	0	0
Kansas	2	0	0	79	88	201	6	0	13	1	1	1
SO. ATL.												
Delaware	0	0	0	16	25	11	0	0	0	0	0	0
Maryland [3]	1	0	0	73	65	56	0	0	0	3	0	1
Dist. of Col.	0	0	0	7	24	21	0	0	0	0	1	1
Virginia	0	0	0	35	27	37	0	0	0	1	2	3
West Virginia [3]	0	1	1	30	78	57	0	0	0	0	2	2
North Carolina [4]	2	0	0	41	55	42	0	0	0	1	0	1
South Carolina [4]	0	0	0	16	8	6	0	0	0	0	1	1
Georgia [4]	2	0	0	21	18	18	0	0	0	4	2	3
Florida [4]	1	0	0	7	20	11	0	0	0	2	2	2
E. SO. CEN.												
Kentucky	2	2	2	90	59	59	0	1	1	0	1	3
Tennessee	1	2	0	91	103	43	2	0	0	5	0	1
Alabama [4]	0	1	0	14	15	19	0	0	0	0	0	1
Mississippi [3]	0	0	0	5	6	7	0	3	1	3	1	2
W. SO. CEN.												
Arkansas	2	1	0	27	7	10	0	2	4	1	1	1
Louisiana [4]	0	1	1	11	6	8	0	0	0	1	3	5
Oklahoma	0	1	1	30	23	35	0	1	1	0	4	3
Texas [4]	0	4	2	30	53	108	0	1	2	8	7	9
MOUNTAIN												
Montana	0	0	0	45	24	32	0	0	6	0	1	1
Idaho	0	0	1	14	12	22	0	0	4	0	2	1
Wyoming	0	0	0	8	9	11	1	1	0	0	0	0
Colorado	0	0	0	26	55	37	2	9	9	2	0	0
New Mexico	0	0	0	5	21	21	0	0	0	0	2	2
Arizona	0	0	0	5	4	13	0	1	0	0	0	0
Utah [3]	1	2	0	13	28	33	0	1	0	0	1	0
Nevada	0	------	------	0	------	------	0	------	------	0	------	------
PACIFIC												
Washington	0	0	0	18	58	57	0	0	2	0	0	0
Oregon	0	0	0	17	18	48	0	0	3	0	1	1
California	3	3	2	142	162	176	0	0	9	2	3	3
Total	28	27	25	3,419	4,904	5,781	37	55	253	47	64	105
7 weeks	245	230	150	22,889	30,855	41,718	341	508	2,081	492	539	776

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended February 15, 1941, and comparison with corresponding week af 1940 and 5-year median—Continued

Division and State	Whooping cough	
	Week ended	
	Feb. 15, 1941	Feb. 17, 1940
NEW ENG.		
Maine	9	34
New Hampshire	3	3
Vermont	7	41
Massachusetts	244	119
Rhode Island	8	3
Connecticut	56	45
MID. ATL.		
New York	332	418
New Jersey	105	120
Pennsylvania	96	377
E. NO. CEN.		
Ohio [3]	158	224
Indiana	38	34
Illinois	106	75
Michigan [5]	254	145
Wisconsin	98	137
W. NO. CEN.		
Minnesota	43	20
Iowa	30	12
Missouri	28	9
North Dakota	7	3
South Dakota	19	2
Nebraska	4	5
Kansas	152	43
SO. ATL.		
Delaware	17	11
Maryland [3]	102	116
Dist. of Col	10	18
Virginia	148	47
West Virginia [3]	43	21
North Carolina [4]	271	84
SO. ATL.—continued		
South Carolina [4]	78	15
Georgia [4]	14	27
Florida [4]	4	7
E. SO. CEN.		
Kentucky	88	48
Tennessee	64	37
Alabama [4]	25	33
Mississippi [3]		
W. SO. CEN.		
Arkansas	8	5
Louisiana [4]	3	11
Oklahoma	29	0
Texas [4]	387	136
MOUNTAIN		
Montana	5	4
Idaho	9	0
Wyoming	2	8
Colorado	55	12
New Mexico	14	60
Arizona	33	12
Utah [3]	120	79
Nevada	6	
PACIFIC		
Washington	73	26
Oregon	15	26
California	259	153
Total	3,679	2,865
weeks	29,113	19,585

[1] New York City only.
[2] Report for 4 days.
[3] Period ended earlier than Saturday.
[4] Typhus fever, week ended February 15, 1941, 24 cases, as follows: North Carolina, 2; South Carolina, 1; Georgia, 9; Florida, 4; Alabama, 2; Louisiana, 3; Texas, 3.
[5] Delayed reports of approximately 700 cases included.

WEEKLY REPORTS FROM CITIES

City reports for week ended February 1, 1941

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	161	1,379	142	3,188	925	1,775	34	371	17	1,094	--------
Current week [1]	65	5,849	194	6,009	777	1,077	5	347	24	1,223	--------
Maine:											
Portland	0	------	0	0	9	0	0	1	0	13	30
New Hampshire:											
Concord	0	------	0	0	0	0	0	0	0	0	19
Manchester	0	------	3	0	3	1	0	1	0	0	40
Nashua	0	------	0	0	2	0	0	0	0	0	14
Vermont:											
Barre	0	------	0	0	0	0	0	1	0	0	3
Burlington	0	------	0	4	0	0	0	0	0	0	10
Massachusetts:											
Boston	1	------	3	138	14	33	0	8	1	75	284
Fall River	1	------	0	0	3	6	0	2	0	5	49
Springfield	0	------	0	0	2	17	0	1	1	0	36
Worcester	0	------	0	64	6	2	0	2	0	0	57
Rhode Island:											
Pawtucket	0	------	0	0	0	1	0	0	0	0	27
Providence	0	23	0	0	13	8	0	4	0	10	116
Connecticut:											
Bridgeport	0	4	2	0	7	0	0	0	0	3	42
Hartford	0	5	2	0	5	1	0	0	0	3	52
New Haven	0	13	2	0	5	11	0	1	3	8	50
New York:											
Buffalo	0	13	7	63	22	20	0	8	1	15	171
New York	13	632	9	1,943	120	199	0	60	4	110	1,633
Rochester	0	------	0	8	8	0	0	1	0	11	94
Syracuse	0	------	0	0	4	0	0	0	0	19	69
New Jersey:											
Camden	1	20	3	64	2	3	0	2	0	10	34
Newark	0	86	0	121	10	39	0	6	0	10	105
Trenton	0	47	2	6	15	57	0	1	0	4	53
Pennsylvania:											
Philadelphia	0	23	12	750	56	69	0	30	1	48	640
Pittsburgh	0	20	7	1	31	7	0	10	0	44	224
Reading	0	3	5	183	1	0	0	2	0	7	39
Ohio:											
Cincinnati	3	29	2	24	11	10	0	7	0	0	152
Cleveland	0	518	5	533	22	26	0	4	0	114	240
Columbus	0	5	5	32	11	13	0	1	0	20	115
Toledo	0	2	1	2	6	6	0	1	0	17	63
Indiana:											
Anderson	0	------	0	0	1	2	0	0	0	0	18
Fort Wayne	1	------	0	19	5	0	0	1	0	0	34
Indianapolis	2	------	2	7	21	17	0	1	0	5	119
Muncie	0	------	0	4	5	4	0	0	0	0	20
South Bend	0	------	0	7	0	1	0	0	0	0	12
Terre Haute	0	------	1	0	1	0	0	0	0	0	10
Illinois:											
Alton	0	1	1	0	2	3	0	0	0	0	9
Chicago	9	44	6	998	39	169	0	30	0	77	782
Elgin	0	------	0	15	0	0	0	0	0	0	4
Moline	0	------	0	3	0	2	0	0	0	0	13
Springfield	0	------	0	0	6	8	0	0	0	2	25
Michigan:											
Detroit	2	95	7	548	22	95	0	10	0	130	306
Flint	0	------	4	40	7	2	0	0	0	12	35
Grand Rapids	0	2	2	10	2	2	0	1	0	14	42
Wisconsin:											
Kenosha	0	------	0	50	0	0	0	0	0	0	7
Madison	0	------	0	1	0	2	0	0	0	2	11
Milwaukee	0	2	0	43	4	29	0	2	0	45	98
Racine	0	------	0	3	0	3	0	0	0	3	11
Superior	0	------	0	1	3	1	1	0	0	0	16
Minnesota:											
Duluth	0	------	1	1	5	0	1	0	0	6	29
Minneapolis	0	1,958	1	1	10	9	0	2	0	40	157
St. Paul	0	------	0	1	8	8	0	0	0	7	70

City reports for week ended February 1, 1941—Continued

State and city	Diphtheria cases	Influenza Cases	Influenza Deaths	Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
Iowa:											
Cedar Rapids	0		0	0	0	3	0	0	0	0	
Davenport	0			0		1	0		0	0	
Des Moines	2		0	0	0	5	0	0	0	9	27
Sioux City	1			0		0	0		0	4	
Waterloo	0			0		2	0		0	4	
Missouri:											
Kansas City	2	1	0	3	8	8	1	2	0	16	105
St. Joseph	0		1	0	7	1	0	1	0	1	32
St. Louis	0	45	2	8	14	41	0	4	0	23	209
North Dakota:											
Fargo	0			0		0	0		0	2	
Grand Forks	0			0		0	0		0	0	
Minot	0		0	2	0	0	0	0	0	1	7
South Dakota:											
Aberdeen	0			0		1	0		0	1	
Sioux Falls	0		0	0	0	2	0	0	0	0	9
Nebraska:											
Lincoln	0			2		3	0		0	3	
Omaha	0		3	0	2	3	1	2	0	1	61
Kansas:											
Lawrence	0	27	0	7	0	0	0	0	0	0	3
Topeka	0	12	2	25	5	2	0	1	0	0	42
Wichita	0	1	0	1	4	3	0	3	0	17	34
Delaware:											
Wilmington	2		0	16	8	3	0	2	0	9	45
Maryland:											
Baltimore	0	65	7	4	15	33	0	15	2	74	282
Cumberland	0	2	1	0	0	2	0	0	0	1	14
Frederick	0		0	0	0	0	0	0	0	0	6
Dist. of Col.:											
Washington	2	124	5	14	33	16	0	15	0	8	237
Virginia:											
Lynchburg	1		0	0	2	0	0	0	0	0	16
Norfolk	0	281	0	2	5	2	0	3	0	3	43
Richmond	0	506	4	6	8	0	0	2	0	1	73
Roanoke	1		3	155	0	1	0	0	0	2	14
West Virginia:											
Charleston	0		0	1	11	0	0	1	0	3	49
Huntington	0			0		0	0		0	0	
Wheeling	0		2	0	3	1	0	1	1	12	24
North Carolina:											
Gastonia	0	1		2		0	0		0	2	
Raleigh	0		1	2	3	0	0	1	0	12	34
Wilmington	0		0	1	2	0	0	0	0	0	15
Winston-Salem	0		0	0	1	2	0	1	0	31	21
South Carolina:											
Charleston	0	505	4	10	9	2	0	0	0	0	34
Florence	0	165	0	17	0	0	0	0	0	0	3
Greenville	0		0	5	2	1	0	0	0	13	12
Georgia:											
Atlanta	0	71	2	7	9	6	0	5	1	3	94
Brunswick	0	1	1	0	1	0	0	1	0	0	6
Savannah	0	145	2	0	2	1	0		0	0	28
Florida:											
Miami	1	27	2	0	2	1	0	3	0	1	56
Tampa	0	4	4	0	3	0	0	1	0	0	26
Kentucky:											
Ashland	0	8	1	0	1	1	0	2	0	3	11
Covington	0	5	0	11	2	0	0	1	0	1	14
Lexington	0		0	9	5	1	0	3	0	1	23
Louisville	0	51	1	11	8	20	0	3	0	14	83
Tennessee:											
Knoxville	0	30	6	2	10	3	0	1	1	13	54
Memphis	0	30	8	9	5	9	0	5	0	3	85
Nashville	0		4	6	6	0	0	2	0	15	78
Alabama:											
Birmingham	2	515	10	16	10	4	0	5	0	5	102
Mobile	0	19	6	1	4	2	0	3	0	0	37
Montgomery	0	25		0		0	0		0	4	
Arkansas:											
Fort Smith	0			0		0	0		0	0	
Little Rock	0	35	0	16	6	0	0	1	0	0	28

City reports for week ended February 1, 1941—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Louisiana:											
Lake Charles	0	------	0	0	2	0	0	0	0	0	6
New Orleans	3	32	5	2	18	5	0	16	4	5	166
Shreveport	0	------	0	0	4	1	1	2	0	0	47
Oklahoma:											
Oklahoma City	0	16	1	0	2	4	0	0	0	0	40
Tulsa	1	------	0	1	4	4	0	0	0	5	24
Texas:											
Dallas	1	4	4	0	6	7	0	1	1	0	71
Fort Worth	0	------	3	72	8	4	0	1	0	0	53
Galveston	0	------	0	16	3	1	0	1	2	0	16
Houston	4	6	2	1	8	1	0	7	0	2	104
San Antonio	2	11	3	0	8	3	0	5	0	2	66
Montana:											
Billings	0	------	0	0	0	0	0	0	0	0	10
Great Falls	1	------	0	1	3	2	0	0	0	0	12
Helena	0	------	0	0	1	0	0	0	0	0	4
Missoula	0	10	0	0	1	2	0	0	0	0	15
Idaho:											
Boise	0	------	0	0	2	2	0	0	0	0	4
Colorado:											
Colorado Springs	0	------	1	0	0	1	0	0	0	12	8
Denver	7	55	8	5	11	3	0	3	1	12	106
Pueblo	1	------	3	1	1	0	0	0	0	3	14
New Mexico:											
Albuquerque	0	------	0	1	3	0	0	3	0	0	11
Utah:											
Salt Lake City	1	------	0	6	0	3	0	0	0	4	37
Washington:											
Seattle	0	------	1	6	2	2	0	3	0	13	87
Spokane	0	1	------	1	------	1	0	------	0	0	------
Tacoma	0	------	0	0	1	1	0	0	0	0	21
Oregon:											
Portland	0	5	0	11	4	1	0	4	0	0	84
Salem	0	1	------	2	------	2	0	------	0	0	------
California:											
Los Angeles	2	91	4	7	4	32	0	20	0	33	361
Sacramento	0	4	2	0	4	3	0	1	0	1	35
San Francisco	0	12	0	3	9	3	0	13	1	39	216

State and city	Meningococcus meningitis		Poliomyelitis cases	State and city	Meningococcus meningitis		Poliomyelitis cases
	Cases	Deaths			Cases	Deaths	
Connecticut:				**South Carolina:**			
Bridgeport	1	1	0	Charleston	3	0	0
New York:				**Florida:**			
New York	1	2	1	Miami	1	0	0
Pennsylvania:				**Tennessee:**			
Pittsburgh	1	0	0	Knoxville	1	0	0
Indiana.				Nashville	1	1	0
Indianapolis	1	0	0	**Alabama:**			
Illinois:				Birmingham	1	0	0
Chicago	0	0	1	**Louisiana:**			
Missouri:				Shreveport	1	1	0
St. Louis	0	0	1	**Texas:**			
West Virginia:				Houston	1	0	0
Wheeling	0	1	0				

Encephalitis, epidemic or lethargic.—Cases: New York, 3; Denver, 2.
Pellagra.—Cases: Boston, 1; Charleston, S. C., 1; Atlanta, 1; Savannah, 1; Knoxville, 1.
Typhus fever.—Cases: New York, 1; Atlanta, 1; Savannah, 1; New Orleans, 2.

FOREIGN REPORTS

CANADA

Increase in cerebrospinal meningitis.—An increase in the incidence of cerebrospinal meningitis has been reported in Canada, beginning with the first week of October 1940. From the week ended October 5, 1940, to the week ended January 18, 1941, a total of 316 cases had been reported as compared with 47 cases for the corresponding period of 1939–40. The Provinces reporting the largest numbers of cases were Ontario (117), Nova Scotia (54), and Quebec (55).

Provinces—Communicable diseases—Week ended January 11, 1941.—During the week ended January 11, 1941, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis	4	9	4	14	20	1		3	7	62
Chickenpox		21		78	454	51	17	72	98	791
Diphtheria		42	2	15	2	6		2		69
Dysentery				2						2
Influenza		380			303	6	102		500	1,291
Measles		460	26	21	677	154	55	282	573	2,248
Mumps				47	99	14	2	10	26	198
Pneumonia		15			30	1	2		14	62
Poliomyelitis				1	1					2
Scarlet fever	1	43	8	53	148	9	8	13	17	300
Tuberculosis	1	7	9	17	45	5				84
Typhoid and paratyphoid fever			1	8					1	10
Whooping cough		4		49	134	20	7	5	9	228

CUBA

Provinces—Notifiable diseases—4 weeks ended January 4, 1941.—During the 4 weeks ended January 4, 1941, cases of certain notifiable diseases were reported in the Provinces of Cuba as follows:

Disease	Pinar del Rio	Habana[1]	Matanzas	Santa Clara	Camaguey	Oriente	Total
Cancer	4			10		9	23
Diphtheria	8	37	5	3		9	57
Hookworm disease		22		3			25
Leprosy						5	5
Malaria	4	6		9	3	204	226
Poliomyelitis		1					1
Scarlet fever		4		2			6
Tuberculosis	29	56	17	59	4	33	198
Typhoid fever	22	34	4	15	13	25	113

[1] Includes the city of Habana.

SWITZERLAND

Notifiable diseases—September 1940.—During the month of September 1940, cases of certain notifiable diseases were reported in Switzerland as follows:

Disease	Cases	Disease	Cases
Anthrax	1	Paratyphoid fever	11
Cerebrospinal meningitis	27	Poliomyelitis	44
Chickenpox	93	Scarlet fever	332
Diphtheria	52	Tuberculosis	201
German measles	8	Typhoid fever	13
Measles	88	Undulant fever	11
Mumps	39	Whooping cough	139

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—A cumulative table giving current information regarding the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS of January 31, 1941, pages 206–210. A similar table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Plague

Morocco.—During the week ended February 1, 1941, 64 cases of plague were reported among the tribes of the Agadir Territory and the Marrakesh region, Morocco.

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